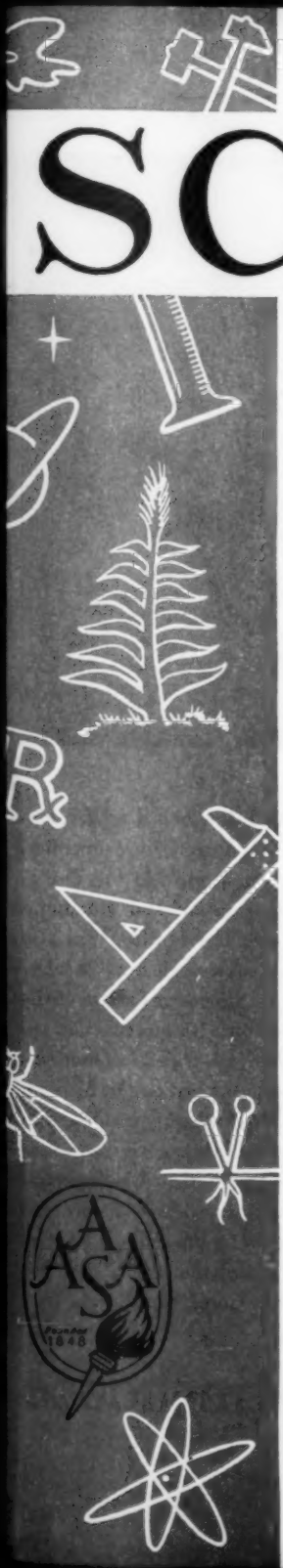

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Contents

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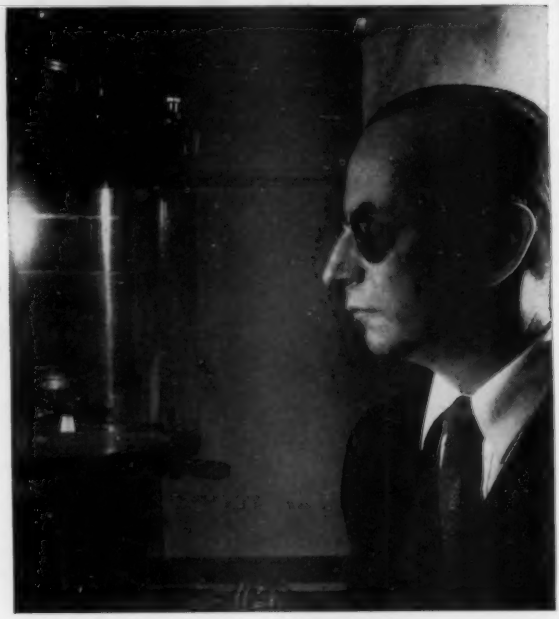
Adventurers in Research . . .

Dr. Joseph Slepian

INVENTOR-SCIENTIST



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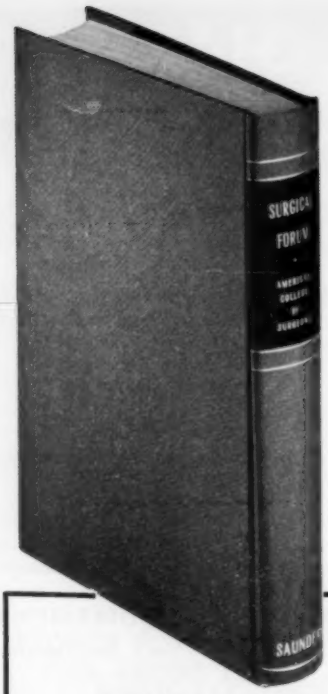

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SCIENCE

Anthropology in Medicine

Social anthropologists and other social scientists have been doing unusual things of late: participating with physicians in conferences on social medicine, teaching in medical schools, working with public health services in Peru, studying the social structure of hospitals, interviewing patients about to undergo plastic surgery, and doing psychotherapy with Plains Indians. These activities are indicative of a tentative liaison between social science and medicine; but as yet there has been little real intercommunication.

The interest shown by physicians in the psychological and social concomitants of bodily disease reflects the apparent increase in the incidence of chronic physical and mental illness, and reawakened interest in the multiple stress and multicausal aspects of disease. Physicians seek emotional correlates of organic illness and emphasize the stresses placed on man by nature, culture, and society. Psychiatrists, especially psychoanalysts, look for the organic correlates of emotional illness and see culture as part of the outer layers of personality that must be peeled back to get at deeper unconscious emotional constellations. The anthropologist must protest both such formulations of culture: the former as setting man in opposition to society, the latter as not recognizing that culture is, from the moment of birth, built into the conscious and unconscious structure of the personality.

John Ryle, in his *Changing Disciplines*, speaks of our "modern endemics" and says, "In the midst of great social changes we have not succeeded in registering and explaining the accompanying changes in the quantity and quality of many of our main diseases." It is not those in the lowest social strata that are most subject to modern endemic disorders. The pattern of socioeconomic incidence of diabetes, coronary disease, hypertensive disorders, and gastric and peptic ulcer does not conform to the socioeconomic pattern of tuberculosis or infant mortality. The future should show much closer collaboration between social science and medicine in the investigation of multiple stress illnesses.

Disease and the practice of medicine are of interest to social scientists. One problem is centered in the study of the hospital as a social system. Unlike almost any other institution in our society, a hospital permits little upward movement: no aide can ever become a technician, no technician can become a nurse, and no nurse can become a doctor. If an individual wishes to change his occupational class, he must leave the system for prolonged training before returning at a higher level. Such a social structure has important effects on the nature and flow of communication through the system.

This problem in communication is of particular importance in mental hospitals, where the illnesses of most patients are rooted in the pathology of interpersonal relations. In its historical development, the mental hospital took over the formal structure of the general hospital; yet it seems likely that the rigid and custodial character of most mental hospitals is not the most satisfactory setting within which to study and treat patients suffering from difficulties in getting along with their fellow-men. The patient's behavior has meaning in terms of the immediate interpersonal situation, and is not to be derived entirely from his past history or from an unconscious that is isolated from reality.

A great many patients now admitted to our mental hospitals might fare better under ambulatory treatment. At the same time, many patients must temporarily be removed from the anxiety-provoking setting of the home. This dilemma raises many theoretical and practical problems, and seems to call for collaborative research between social science and psychiatry on other types of environmental settings that might be more conducive to successful psychotherapeutic treatment.

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The Role of Heparin in Lipoprotein Metabolism

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RECENT STUDIES BY GOFMAN AND HIS COLLABORATORS (*1*) have suggested the existence of a direct relationship between the plasma levels of certain physically distinct lipoprotein moieties and the incidence of atherosclerotic lesions. These long-range correlative studies have recently been given considerable support by the acute studies of Bragdon (*2*). His experiments, involving the production of early lesions in experimental animals by infusion of ultracentrifugally fractionated hypercholesterolemic plasma, indicate that pathogenicity may be much more closely related to the levels of certain cholesterol-protein complexes than to the level of total plasma cholesterol itself.

Although accurate interpretation of these findings must await the accumulation of additional data, the tentative conclusions are of considerable interest to biochemist and clinician alike, since they suggest that a specific chemical defect may be an important etiologic factor in atherosclerosis. In common with several other laboratories, therefore, we have begun studies on the nature of the linkages that bind cholesterol and fats to protein molecules, and of the homeostatic mechanisms that control the relative concentrations of lipoprotein classes in plasma.

In 1943 Hahn (*3*) observed that heparin caused rapid clearing of alimentary lipemic plasma *in vivo*, but that this decrease in turbidity did not occur *in vitro*. Other heparinlike substances also produce such effects (*4*). It was recently found by Anderson (*5*) that this "clearing" phenomenon could be brought about *in vitro* by treating lipemic plasma with plasma withdrawn from donor animals shortly after intravenous administration of heparin. Anderson's results indicated that heparin administration activated, or stimulated the production of, a substance in plasma possessing "antichylomicronemic" properties.

The hypothesis that heparin may play a specific role in lipid metabolism and transport has recently been extended by the findings of Graham and his collaborators (*6*), who observed that heparin administration in rabbits and humans caused a marked reorientation in the distribution of low-density lipoproteins and retarded the formation of high levels of so-called S_f 10–50 lipoproteins during cholesterol feeding. This latter observation is of particular interest in view of the postulated relation between lipoproteins of this density class and the incidence and induction of atheromata (*1, 2*).

In order to facilitate a study of the mechanism of the heparin effect, experiments were undertaken to purify and define the components of the *in vitro* system described by Anderson (*5*). Since it was of primary importance from the standpoint of experimental simplification to be able to produce "clearing factor" in an isolated tissue system, preliminary studies were carried out to determine the richest sources of activity. Restricted perfusions of anesthetized rats and dogs with heparinized plasma indicated that the abdominal and thoracic regions were capable of producing clearing activity at high levels. Perfusion of isolated hind limbs in a similar manner produced no clearing factor.[1] The content of clearing factor was assayed by measuring the decrease in turbidity per unit time upon incubating the perfusate with alimentary lipemic plasma obtained from dogs previously fed a fatty meal. In these experiments, control perfusions with heparinized saline, before and after perfusion with heparinized plasma, did not yield active material. It appeared, therefore, that material in plasma was being converted to clearing factor under the influence of a tissue catalyst and in the presence of heparin.

The data obtained thus far indicate that, of the tissues tested, heart and lung are most active in carrying out this conversion. In these experiments, rat tissue minces were incubated at 38° C or at room temperature with pooled human plasma to which heparin had been added. After centrifugation, the supernatants were tested for clearing activity against lipemic dog serum, as described above. Although the nature of this tissue factor cannot be ascertained on the basis of present data, preliminary experiments indicate that cell-free saline homogenates of heart and lung tissue retain the ability to catalyze clearing factor production from plasma. The results of a typical experiment of this sort are presented in Fig. 1. The data demonstrate that each of the components—tissue extract, heparin, and plasma—must be present for the production of active material. A small but demonstrable formation of clearing factor was observed in certain plasma samples incubated with heparin in the absence of tissue factor, which suggests that tissue factor may occasionally exist in plasma in low concentrations.

With the *in vitro* incubation technique it was possible to test plasma and plasma fractions for their ability to act as precursor in clearing factor formation. Normal dog plasma and pooled human plasma were fractionated by the low-temperature alcohol

[1] This result is in contrast to the findings of Weld (*7*), who obtained clearing of lipemic blood perfused in this manner. We have also observed some clearing under these conditions, but only in cases where collateral circulation, connecting the hind limb and the abdominal region of the animal, was still partially operative.

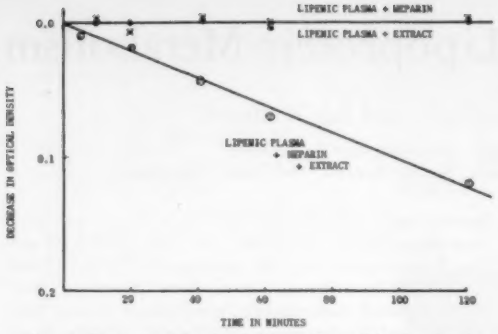

FIG. 1. The essential role of "tissue factor" in the clearing of lipemic plasma: Normal human plasma (0.4 ml) was incubated with 0.4 ml of a 4:1 saline homogenate of rat heart in the presence and absence of heparin (0.25 mg). In the upper control, heart extract was replaced by 0.25 mg heparin in 0.15 *M* NaCl. After 15 min at 37° C, the tubes were centrifuged, 0.5 ml of dog alimentary lipemic serum was added to 0.5 ml of the supernatant, and the rate of decrease in turbidity determined.

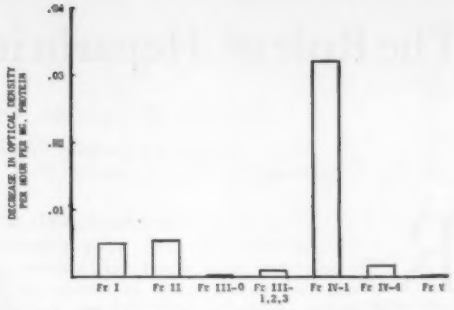

FIG. 2. The distribution of clearing factor-precursor in normal human plasma: A solution of each fraction in 0.15 *M* NaCl, at a concentration equivalent to that in whole plasma, was incubated with a tissue-factor preparation for 15 min in the presence of heparin, and centrifuged. The supernatant was tested against lipemic dog plasma for clearing factor activity.

methods of Cohn, Edsall, and their collaborators (*8*), following their procedures 10 and 6+9.

The lyophilized fractions were then incubated with minced heart or lung tissue in the presence of heparin. After centrifugation, the supernatants were tested for clearing factor activity. Although a completely sharp fractionation of precursor substance was not obtained in these preliminary experiments, the data in Fig. 2 clearly indicate that the bulk of this material is localized in Fraction IV–1.

The fractionation characteristics of the clearing factor itself were determined, for the most part, on samples of plasma derived from humans, rats, cats, or dogs which had received intravenous heparin.[2] The activity produced by such injections was roughly proportional to the amount of heparin administered.

In Fig. 3 is presented a typical assay for clearing factor activity, in which rough proportionality between the volume of active plasma used and the change in turbidity is demonstrated. Upon low temperature alcohol fractionation, clearing activity was found to be localized, for the most part, in Fraction III–1, 2, 3 (Fig. 4), although Fractions III–0 and I exhibited considerable activity as well. It is felt that the activity found in Fraction III–0 is not comparable with that in other fractions since, as will become evident, this fraction contains still another component of the complete clearing system in particularly high concentration. The purification of the clearing factor by the single alcohol fractionation employed (Method 6+9) is about fourteenfold over the original plasma on a protein-nitrogen basis. Its abundant presence in Fraction III–1, 2, 3 confirms and extends the results of Graham *et al.* (*6*), who reported that the factor fell in the ultracentrifugal globulin fraction.

[2] Rabbits of the NIH strain were not good sources of clearing factor, nor was the lipemic plasma of cholesterol-oil-fed rabbits significantly changed by clearing factor from other sources in respect to either lipoprotein pattern or turbidity. The positive ultracentrifugal results of the Donner Laboratory group may well be explained on the basis of species variation (personal communication from J. W. Gofman).

Clearing factor is destroyed by heating at 60° C for 3 min, high levels of salt, and chymotrypsin digestion (Fig. 5, *A*). Its activity in clearing the turbidity of lipemic plasmas is maximal at approximately 40° (Fig. 5, *B*). The optimal pH for the clearing reaction is about 7.4. Clearing factor (as well as precursor (Fraction IV–1) and the tissue factor described above) withstand dialysis and lyophilization. The properties of clearing factor suggest that it may be enzymatic in nature, although further kinetic and equilibrium data are necessary to establish this point conclusively.

In order to simplify the test system for the assay of clearing factor activity, experiments were carried out in which the purified factor, Fraction III–1, 2, 3, was allowed to act on lipoproteins prepared by flotation from lipemic plasma, rather than on the plasma itself. The lipoprotein substrate was prepared by ultracentrifugation, at 80,000 *g* for one hour, of alimentary lipemic dog plasma layered under 0.85 per cent saline. Surprisingly, no decrease in turbidity was observed without the simultaneous addition of the in-

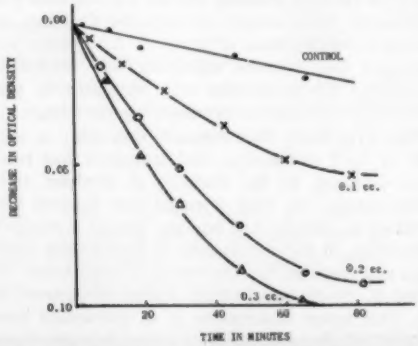

FIG. 3. The decrease in turbidity of lipemic serum as a function of clearing factor concentration: Plasma from a 17-kg dog given 25 mg of heparin intravenously 10 min before bleeding was used as a source of clearing factor; 0.0, 0.1, 0.2, and 0.3 ml were added to 0.5 ml lipemic human plasma, and total volumes adjusted to 1.0 ml with 0.15 *M* NaCl.

franatant fraction of plasma. These findings suggested the involvement of an additional "coprotein" acting in the capacity of acceptor or stimulator in the clearing system. Alcohol fractionation of plasma resulted in the partial purification of this coprotein to the extent of about fivefold. The data summarized in Fig. 6 indicate the essential role of this component in the clearing reaction. The distribution of coprotein among various plasma fractions is shown in Fig. 7, and it will be seen that the bulk of this material was found in Fraction III–0. Subsequent ultracentrifugal purification has demonstrated that coprotein activity resides in the nonlipoprotein portion of this fraction.

A tentative scheme, based on the fractionation studies described above, is presented in Fig. 8. In this scheme, a soluble tissue substance is depicted as catalyzing the conversion of a component of plasma, Fraction IV–1 to clearing factor, in the presence of added heparin (reaction A). The role of heparin in this reaction is obscure at present, although the possibility that heparin occurs as a tightly bound prosthetic group of clearing factor is suggested by the finding that active Fraction III–1, 2, 3 contains levels

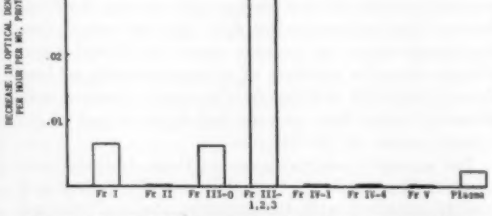

FIG. 4. The distribution of clearing factor in the plasma of an 18-kg dog which had received 500 mg of heparin 15 min before bleeding.

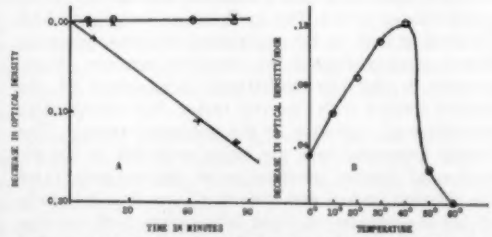

FIG. 5. A solution of each fraction in 0.15 *M* NaCl at a concentration equivalent to that in whole plasma was tested for clearing factor activity against alimentary lipemic dog serum. *A*, the action of chymotrypsin on clearing factor: Lower curve, untreated clearing factor (5 mg); upper curve, 0, clearing factor (5 mg) with 0.2 mg chymotrypsin; upper curve, *X*, 0.2 mg chymotrypsin. The proteins were dissolved in 1 ml 0.15 *M* NaCl. All tubes were buffered to pH 7.9 with phosphate buffer, final concentration 0.003 *M*. All were incubated at 37° C for 1 hr, and tested for clearing factor activity against alimentary lipemic dog serum.

B, the activity of clearing factor as a function of temperature. All samples were placed in a 37° C bath for 3 min before reading in the colorimeter, since lipemia turbidity varies with temperature.

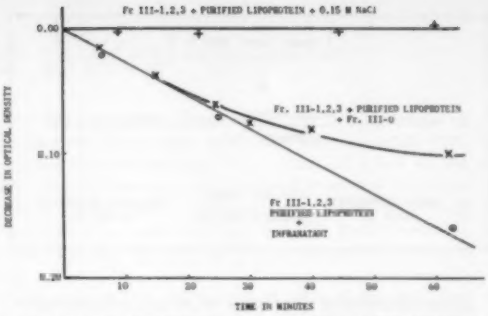

FIG. 6. The involvement of coprotein in the clearing of lipemic plasma: Five ml of dog alimentary lipemic serum was layered under 5 ml of 0.15 *M* NaCl and centrifuged at 80,000 *g* for 1 hr. The top 1 ml, containing very low-density lipoproteins, was separated by the tube-slicing technique, and the bottom 2 ml of infranatant was withdrawn. The following determinations were set up: Middle curve, 5 mg purified clearing factor (Fraction III–1, 2, 3) + 14.2 mg purified coprotein (Fraction III–0) + water, 0.9 ml; lower curve, 5 mg purified clearing factor + infranatant, 0.5 ml, + 0.15 *M* NaCl, 0.4 ml; upper curve, 5 mg purified clearing factor + 0.15 *M* NaCl, 0.9 ml. After warming, 0.1 ml of the purified lipoprotein was added to each, and the rate of decrease of turbidity determined.

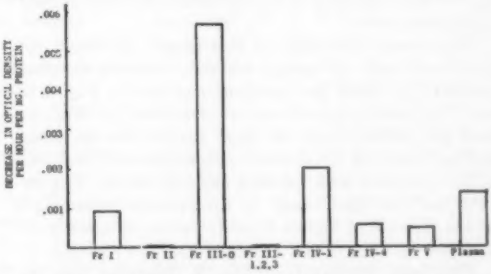

FIG. 7. The distribution of coprotein in normal human plasma: Normal human plasma fractions were dissolved in 0.15 *M* NaCl at a concentration twice that in the original plasma. To 0.5 ml of these fractions was added 0.5 mg of purified clearing factor in 0.4 ml 0.15 *M* NaCl, and after warming to 37° C, 0.1 ml of purified lipoproteins prepared by layering 5 ml of dog alimentary lipemia serum under 5 ml of 0.15 *M* NaCl, centrifuging for ½ hr at 80,000 *g* in the Spinco preparative ultracentrifuge, and discarding all but the top 1 ml of solution. The turbidity was recorded at various times after the addition of lipoprotein.

of bound heparin far in excess of that predicted by uniform distribution of the injected material in the total plasma space.[3]

In reaction B, clearing factor is pictured as catalyzing the physical or chemical redistribution of plasma lipids in such a way that turbidity is decreased, or, as in the ultracentrifugal studies of Graham *et al.*, and in certain of our own, a reorientation of plasma lipoproteins is brought about. The involvement of "coprotein" in this reaction suggests an acceptor role for this substance, although certain alternative explanations cannot be ruled out.

[3] The authors wish to express their sincere thanks to E. Cronkite, of the National Naval Medical Center, for carrying out the heparin assays.

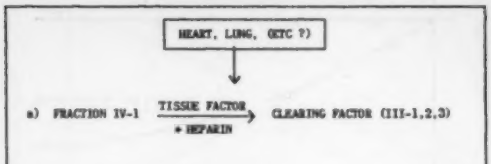

FIG. 8.

Since substantial quantities of clearing factor precursor and tissue factor exist in normal animals, the over-all data suggest that clearing factor may exist normally in plasma in low concentrations, dependent on available heparin supplies. This conclusion is supported by the finding that normal control rats, which are the most responsive of the experimental animals tested for ability to produce clearing factor upon heparin administration, frequently exhibit easily demonstrable clearing activity. The complete absence of atheromata in rats is well known (although early lesions have recently been induced in these animals by direct transfusion of human and rabbit low-density lipoproteins).[4]

The studies described in this paper are based for the most part on assays by the turbidity-decrease method. To relate the reactions outlined in Fig. 8 to the "lipoprotein reorientation" described by Graham and his collaborators, we have carried out ultracentrifugal tests on lipoprotein preparations before and after treatment with purified clearing factor. The results indicate that lower S_f lipoproteins accumulate at the expense of higher S_f components, in accordance with the findings of the Donner Laboratory group.

The data presented in Fig. 9 illustrate this reorientation phenomenon brought about by the action of purified clearing factor on the lipoproteins of a 62-year-old male individual with proved myocardial infarction. Three ml of serum was incubated with 40 mg of Fraction III–1, 2, 3 (active clearing factor) for 5 hours at 37° with gentle agitation. A control sample was run without clearing factor.

At the end of the incubation period the volume of the samples was brought to 10 ml and a density of 1.063 by the addition of NaCl solution. The low-density lipoproteins were separated by centrifugation at 79,640 *g* for 18 hours. The top 1.3 ml of each sample was removed by the tube-slicing technique and analyzed simultaneously in the 12-mm regular and wedge cells of the analytical Spinco ultracentrifuge to insure identical conditions during centrifugation. Photographs were taken at the intervals and speeds indicated in the legend of Fig. 9. The upper patterns in each case are from the treated sample.

Figure 9, *B* indicates that a decrease in the concentration of the S_f 30–150 class of lipoproteins has occurred in the sample treated with clearing factor. The patterns in Fig. 9, *C* indicate a decrease in the S_f 20–30 class (visible in the lower pattern as an inverted peak) and an increase in the S_f 10–20 lipoproteins in the treated sample. The concentration and distribution of the "normal" S_f 3–10 lipoproteins remain unchanged (Fig. 9, *D*).

[4] J. Bragdon and E. Boyle. Presented at the April meeting of the American Association of Pathologists and Bacteriologists.

A B C D

FIG. 9. The effect of clearing factor on the ultracentrifugal lipoprotein pattern: The upper pattern represents the sample treated with purified clearing factor, and the lower the control. Conditions: 18° C; density of solvent, 1.063; acceleration time, 6 min; inclined slit angle, 60°. Air bubble menisci are on the left of the pattern, components migrating from right to left against the centrifugal field. *A*, 10,000 rpm during acceleration; exposure time, 10 sec. *B*, zero minutes after reaching maximum speed, 56,100 rpm; exposure time, 1 sec. *C*, 2 min; exposure time, 1 sec. *D*, 30 min; exposure time, 1 sec.

During the incubation described above, a considerable decrease in the turbidity of the treated sample was observed during the first hour. In the course of the subsequent 4-hour period, however, a marked increase in turbidity took place. The appearance of the control sample did not change throughout the incubation. The patterns in Fig. 9, *A* (photographed, during acceleration, at a rotor speed of 10,000 rpm) clearly show the presence of a large quantity of low-density material released in the sample treated with clearing factor. This material had migrated out of the optical system at 20,000 rpm.

The accurate interpretation of these findings must await further study. Nevertheless, the ultracentrifugal results combined with the turbidity changes observed suggest that a component of the complete clearing system, probably coprotein, present during the first hour of incubation was exhausted during the subsequent 4-hour period. This explanation is supported by the finding that, in the experiment described above, a direct assay indicated the complete absence of coprotein in the ultracentrifugal infranatant of the sample treated with clearing factor, but considerable quantities of coprotein in the untreated control. The results presented here are being extended in the direction of further purification of the components of the clearing system and toward a more detailed study of the mechanism of lipid labilization both *in vivo* and *in vitro* under the influence of these purified materials.

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News and Notes

Mexican Anthropology

INSUFFICIENT attention has been given to a series of unusually fruitful international conferences in anthropology held in Mexico under the sponsorship of the Sociedad Mexicana de Antropología and, more recently, with the additional sponsorship of the Congreso Mexicano de Historia. Each round table has been organized about a limited region in Mexico and has been devoted to an intensive review of knowledge and definition of research problems. Important reclassifications and syntheses have emerged from some of the sessions, and there has been much subsequent research. All the round tables have been attended by the majority of Mexican anthropologists and by a significant number of North American specialists. Sessions have been bilingual, and discussion has been frank and extensive. Most productive of the round tables have perhaps been those on the Olmec, the problem of Tula, and relations between the pre-Columbian cultures of Mexico and the United States.

The fifth round table was held in Jalapa, Vera Cruz, July 22–29, 1951, concurrently with a conference on Vera Cruz history. Sessions were devoted to anthropogeography, physical anthropology, linguistics, and pre-Colonial history. Two sessions each were devoted to ethnology and archaeology, and two to survey and summary papers. The major theme was "The Huastec, Totonac, and their Neighbors." In the course of the meeting an intensive survey was made of existing knowledge regarding the entire state of Vera Cruz and neighboring areas. Many papers reported the results of as yet unpublished research. Important topics requiring research were disclosed, and increased research activity will unquestionably result. Not the least important result was stimulation of official and public interest in research problems and encouragement to research by local scholars. More than 20 North American, 1 French, 2 Guatemalan, and approximately 50 Mexican anthropologists attended the sessions.

An especially significant aspect of the conferences was the opportunity to meet and talk informally with colleagues from other fields, not to mention the almost fabulous hospitality provided by the Mexican hosts. Delegates were transported by bus and car from Mexico City to the state line, where they were met by an official delegation from the government of Vera Cruz. They were then taken for two days to the region of Papantla and had an opportunity to see new explorations in the remarkable ruins of Tajin. In the ancient main plaza delegates were treated to a number of spectacular native Totonac dances, including the rare and striking performance of the volador. The session was officially opened and closed by the governor of the state, who also received the delegates in a special reception. The mayor and town council of the city of Jalapa also presented each delegate with a signed diploma making him a guest of honor of the city. This gesture was implemented in a very practical fashion by the fact that delegates were provided food, transportation, and lodging by the government of Vera Cruz and the city of Jalapa during their entire stay.

Although not an official round table of the Sociedad Mexicana de Antropología, a similar session was sponsored by the Congreso Mexicano de Historia in February. Invited delegates were transported on a destroyer of the Mexican Navy from Acapulco to Mazatlan, La Paz, and Ensenada. All expenses of North American delegates were paid from nearest border point of entry and return. Sessions were held on the destroyer and also at La Paz and Ensenada.

Although the topics considered were concerned primarily with Baja California, the most important discussion centered about the region that has been defined as the Greater Southwest or Arid North America. It became clear that throughout this region many problems ignore the international boundary and call for international collaboration for their solution. The existence of cultures with special ecological adaptations, found nowhere else in the New World, was pointed out. There is also evidence that, throughout much of its human history, the area has been occupied by cultures occupying different ecological niches, and that at various times there have been coexisting cultures dependent primarily on hunting, on the one hand, and on the collection of wild vegetable products, on the other. In addition, in its later phases the region has been marked by the coexistence of cultures of the aforementioned type and cultures practicing farming.

Plans were laid at the February meeting for a small working conference of people with research interests in Arid North America to be held at Hermosillo, Sonora, sometime in 1953. Several participants have expressed the hope that this may lead at least to an informal but nevertheless permanent organization of scholars interested in the area, and to the formulation of related research plans and a continuous exchange of information.

The success of this series of conferences has depended primarily upon the energy and devotion of a group of Mexican scholars, too numerous to list here, who have organized these international meetings with a minimum of government support. Most of the more active individuals are connected with the National Institute of History and Anthropology, the National Museum of Anthropology, and the National School of Anthropology in Mexico City.

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Scientists in the News

At the corporate meeting of the New York Botanical Garden on May 15, the annual Distinguished Service Awards were presented to **Arthur M. Anderson,** a member of the Board of Managers since 1933 and treasurer since 1938, and to **Liberty Hyde Bailey** in acknowledgment of his outstanding career as educator, administrator, and botanical investigator. The citation for exhibits at the New York Botanical Garden was awarded to **Mrs. Charles Burlingham. C. Suydam Cutting,** an explorer of the less accessible parts of the world, was cited for his service to science through the Garden. **Elmer D. Merrill,** director of the Garden from 1930 to 1935, received an award in grateful appreciation of his qualities as a scientist and for his public services. The first presentation of the trophy of the Sarah Gildersleeve Fife Memorial Fund was made to **Bassett Maguire** in recognition of his many explorations in Venezuela. At the meeting, **Charles B. Harding** was re-elected president; **R. Gordon Wasson** was elected treasurer to succeed Arthur M. Anderson, who will continue to serve as a member of the Board of Managers. Others re-elected were **Joseph R. Swan,** chairman of the Board; **Frederick S. Moseley, Jr.,** vice president; **William J. Robbins,** director; **Henry de la Montagne,** secretary and assistant director; **J. Mark Kerans,** administrator, business manager, and assistant treasurer; and **Donald P. Rogers,** assistant secretary.

Hugh H. Bennett has retired from the U. S. Department of Agriculture after nearly half a century of service ranging from soil chemist to special assistant to the Secretary. Dr. Bennett headed the Soil Conservation Service from its beginning in 1933 until October 1951, when he was named special assistant on conservation and resource matters.

Directors of the Corn Products Refining Company have elected **Henry L. Cox** vice president in charge of the chemical division at Argo, Ill. Dr. Cox joined the company in 1944.

John E. Davis is retiring in June as professor of physics, William Jewell College. He has been a member of the faculty since 1907 and was chairman of the Department of Physics from 1912 to 1948.

Herbert McLean Evans, professor of anatomy at the University of California and Hertzian professor of biology and director of the Institute of Experimental Biology, is the winner of the Passano Foundation Award for 1952. In 1922 Dr. Evans discovered vitamin E, and with O. H. and G. A. Emerson first purified and determined the empirical constitution of this vitamin in 1935. With C. H. Li and M. E. Simpson, he was first to purify the anterior-hypophyseal interstitial-cell-stimulating hormone, the adrenocorticotropic hormone, the hypophyseal growth hormone, and the follicule-stimulating hormone. Established in 1943 by the Williams & Wilkins Company, medical publishers of Baltimore, the foundation is dedicated to the encouragement of medical research, especially that having clinical application.

Donald G. Fink will join Philco Corporation on June 1 as co-director of Research–Operations. Mr. Fink has been associated with *Electronics* since 1934 and its editor since 1946.

Thomas Francis, Jr., chairman of the Department of Epidemiology, School of Public Health, University of Michigan, who was the first to discover more than one influenza virus, has been awarded the Howard Ricketts Medal of the University of Chicago. The Ricketts Medal, honoring the late University of Chicago physician who died of typhus May 3, 1910, was established by Mrs. H. R. Ricketts in 1949. Dr. Francis received the medal at the University of Chicago May 12, when he spoke on "The Significance of Variation among Influenza Viruses."

Donald S. Gilmore, president and general manager of The Upjohn Company, has been elected president of the American Drug Manufacturers Association. Mr. Gilmore has been a member of the executive committee of the association since 1942 and a vice president since 1946.

Recent visitors at the National Bureau of Standards included **S. Gopalan,** deputy director-general, All India Radio, New Delhi; **I. Tani,** Aerodynamics Laboratory, University of Tokyo; and **Edouard Regenstreif,** physicist, Scientific Section, Unesco, Paris.

Albert Moore Hand, of Texarkana, Texas, will join the staff of the University of Tennessee College of Medicine July 1 as instructor in the Divisions of Pediatrics and Preventive Medicine. Dr. Hand will investigate the pediatric aspects of preventive medicine.

The following persons from abroad were recent visitors at the Eastern Regional Research Laboratory, USDA, Philadelphia: **P. A. Hanks,** Colonial Sugar Refining Co., Sydney, Australia; **Francis G. Irving,** Mowling and Son, Pty., Ltd., Melbourne; and **Bhalchantea S. Dane,** India.

Harold Jeffreys, professor of geophysics, St. Johns College, Cambridge University, has been named the fourteenth recipient of the William Bowie Medal by the American Geophysical Union (Committee on Geophysics of the National Research Council), at its annual meeting in Washington, D. C. One of the stipulations of the award is that the recipient must have made outstanding contributions to the advancement of cooperative research in geophysics. Dr. Jeffreys, who has long been active in the International Union of Geodesy and Geophysics, as well as in other organizations, has been prominent in cooperative scientific activities. The William Bowie Medal was first awarded in 1939 to the late William Bowie, world-famed geodesist and geophysicist.

Robert H. Krieble has been appointed engineer in

charge of the Thomson Laboratory at the Lynn (Mass.) River Works of the General Electric Company. He succeeds **John I. Hull,** who retired in March. Dr. Krieble, who was in charge of the laboratory's Chemical and Insulation Section, has been a G-E employee since 1943.

Harry S. Ladd, of the U. S. Geological Survey, gave the first lecture of a newly created annual series sponsored by the William F. E. Gurley Foundation for Paleontology under the Department of Geology, Cornell University. The title of his address was "Geologic History of the Pacific Basin."

The Society for Applied Spectroscopy has announced the selection of **William F. Meggers,** of the National Bureau of Standards, as the first recipient of its newly established award for outstanding contributions to the science of applied spectroscopy. Dr. Meggers has been a physicist with NBS since 1914 and has been head of the Spectroscopy Section since 1920. The award is in the form of a suitably inscribed medal.

Marcel Migeotte has been appointed professor of physics at the University of Liége. Dr. Migeotte is well known for his studies of the infrared spectrum of the sun.

Carl Neuberg, research professor of biochemistry at New York Medical College and Polytechnic Institute of Brooklyn, has been invited by the Technical University of Munich, to serve as guest professor in agricultural chemistry. He will lecture during the summer session, and also before the Max Planck Gesellschaft in Goettingen.

James S. Owens, former executive director of the Ohio State University Research Foundation, has joined Champion Spark Plug Company as assistant to the manager of the company's Ceramic Division in Detroit. Dr. Owens, who served also as professor and chairman of the Department of Industrial Research during his five years at Ohio State, previously held industrial research posts with Dow Chemical Company and Armstrong Cork Company.

Don Pletsch, formerly public health adviser, Division of International Health, USPHS, has accepted a position as entomologist of a World Health Organization malaria control demonstration team in Formosa. During a two-year assignment he will work with local malaria personnel on problems of vector bionomics affecting the island-wide malaria eradication program now being initiated.

Paul D. Rosahn, pathologist at the New Britain General Hospital and associate clinical professor of pathology at Yale Medical School, has been designated winner of the second annual Essay Contest of the American Dermatological Association. The prize was awarded for the best essay submitted for original work on some fundamental aspect of dermatology or syphilology. The winning essay, entitled "The Adverse Influence of Syphilitic Infection on the Longevity of Mice and Men," was based on investigations conducted at the New Britain General Hospital and the Yale Medical School, supported by grants from the National Institutes of Health. Dr. Rosahn presented his paper at the meeting of the association at Colorado Springs in April.

Charles M. Switzer, director of the nylon manufacturing division in the Du Pont Company's Textile Fibers Department, has retired and has been succeeded by **George E. McClellan,** director of the rayon manufacturing division. The company announced five other changes in connection with Mr. Switzer's retirement: **W. Sam Carpenter, III,** who has been director of the acetate manufacturing division, was appointed head of the rayon manufacturing division. **William L. Scarborough,** manager of the acetate production section, was appointed to succeed Mr. Carpenter as director. **Thomas Taylor,** manager of the Spruance rayon plant, Richmond, Va., succeeds Mr. Scarborough as manager of the acetate production section. **Rollin F. Conaway,** manager of the Yerkes rayon plant at Buffalo, N. Y., was transferred to the Spruance plant to succeed Mr. Taylor as manager there. **Edward M. Cooper, Jr.,** manufacturing superintendent of the Old Hickory, Tenn., rayon plant, succeeded Dr. Conaway as manager of the Yerkes plant.

Maria Telkes, research associate in metallurgy at the Massachusetts Institute of Technology, became the first to be honored by the Society of Women Engineers' Award for Meritorious Contribution to Engineering. The award was presented at the SWE national convention in New York, by Dorothy R. Young, dean of women at Drexel Institute of Technology.

The board of directors of the National Dairy Products Corporation has named **L. A. Van Bomel** chairman, and **E. E. Stewart** president to succeed Mr. Van Bomel, who had been president for 11 years. **Thomas H. McInnerney,** founder of the company and chairman since 1941, was named chairman emeritus. Mr. Stewart, executive vice president since 1950, vice president since 1944, and a director since 1945, has been with National Dairy and its associated companies 32 years.

Julius Weber, chief of the Department of Photo Research, Beth Israel Hospital, New York, since 1949, has been appointed director of medical photography of Medigraphics Inc. Head of photography at Columbia-Presbyterian Medical Center for ten years, Mr. Weber retains an affiliation with the U. S. Army Chemical Corps and the U. S. Navy Hospital at St. Albans, Long Island, as photographic consultant.

The first award of The New York Academy of Medicine Plaque has been made to **Orrin Sage Wightman,** of New York City. The award was established by the council of the academy to be granted "in recognition

of extraordinary services rendered to the Academy." Dr. Wightman is chairman of the Academy Board of Trustees. He was elected to fellowship in the academy in 1905 and was one of the founders of its Medical Information Bureau.

Hugo Zahnd, of the Department of Chemistry of Brooklyn College, has been granted a leave of absence for the coming academic year. He will spend his leave doing research in the Chemical Laboratories of the University of Basel, Switzerland.

Education

The **Association of University Programs in Hospital Administration,** financed by the W. K. Kellog Foundation, will sponsor an 18-month study of the graduate programs in the field. James A. Hamilton, of the University of Minnesota, is chairman of the independent nine-member commission that will evaluate present educational programs and make specific recommendations for improvement. Herluf V. Olsen, of Dartmouth, will direct the study, assisted by John M. Nicklas. Universities joining in the project are Baylor, California, Chicago, Columbia, Iowa, Johns Hopkins, Minnesota, Northwestern, Pittsburgh, St. Louis, Toronto, Washington, and Yale.

Under the auspices of the Medical Advisory Board of **Hebrew University** and **Hadassah Medical School** a medical workshop will be held in Israel June 3–12. Participants will include Harry Grundfest, Harry Eagle, J. J. Golub, Louis Leiter, Israel S. Wechsler, and Joseph Hirsh. On June 8–10 a symposium on the basic medical sciences will be held under the same auspices. Among the many scientists expected to attend are Ernest Chain (Microbiological Institute, Rome); Dr. Grundfest, David Nachmanson, David Rittenberg, and Heinrich Waelsch (College of Physicians and Surgeons, Columbia University); Severo Ochoa (Bellevue); Kurt G. Stern (Brooklyn Polytechnic); and J. H. Quastel (McGill). In addition to presenting papers, the participants will confer with their Israeli colleagues on medical teaching and research problems and participate in the ground-breaking ceremony on June 5 for the new medical school in Jerusalem.

Lehigh University has appointed James B. Hartman head of the Department of Mechanical Engineering, and Arthur F. Gould head of the Department of Industrial Engineering. Milton C. Stuart, a member of the Lehigh faculty since 1926, who has served as head of mechanical engineering and acting head of industrial engineering, asked to be relieved of administrative duties so that he could devote more time to teaching and research.

Ohio State University will offer a lecture course–colloquium on "Steric Factors in Organic Chemistry." John D. Roberts, of MIT, will lecture from June 17 to mid-July, and Herbert C. Brown, of Purdue, during August. Melvin S. Newman, of the OSU Chemistry Department, will also participate, and further details may be obtained from him.

Tufts College has established a graduate Department of Systems Analysis for the study of man-machine systems, based on the integration of mathematical, physical, engineering, and logical techniques. The work is carried on at the Naval Research Laboratory in Washington, D. C. Assistantships paying $1600–$2000, with remission of tuition, are available for candidates for the M.S. degree. Applications should be made to the dean of the graduate school, Medford 56, Mass.

Grants and Fellowships

American Cyanamid Company has awarded 17 graduate fellowships in chemistry and chemical engineering to students in as many universities. The stipend consists of $1500, full tuition, and incidental laboratory fees, plus $300 for the unrestricted use of the student's department. Cyanamid's program of grants and fellowships also includes financial aid for certain medical and agricultural research projects.

The **Morehead Foundation** has received a gift of $1,000,000 in securities from John M. Morehead to augment previous contributions to the scholarship fund. Recipients of the second annual award of scholarships for graduate work at the University of North Carolina are William W. Abbott, James W. Coley, John L. Hazlehurst 3d, John V. Hunter 3d, Peter G. Kalogridis, Edgar Love 3d, Cornelius T. Patrick, and William A. White.

Chas. Pfizer & Co., pharmaceutical manufacturers, have established a $1000 Pfizer Scholarship for Medical Students at the University of Tennessee College of Medicine.

A. H. Robins Company, Inc., of Richmond, Va., has made a three-year grant of $10,500 to expand a program of clinical research in rheumatic disease at St. Luke's Convalescent Hospital, Greenwich, Conn. Results obtained with salicylates and *p*-aminobenzoic acid will be studied and compared with those obtained with ACTH. R. A. Higgons and Anthony A. Albanese will head the study.

Shell Oil Company has increased its research grants for fellowships about 25 per cent for 1952–53. Twelve grants of $5000 each have been made for basic research in chemistry, chemical engineering, geology, mechanical engineering, metallurgy-corrosion, and physics at Caltech, Carnegie Tech, MIT, Harvard, Yale, Stanford, Princeton, and the University of Chicago. In addition, 45 graduate fellowships, totaling $95,000, have been awarded.

The **Sloan Foundation,** which made a gift of $5,250,000 to MIT to establish the new School of Industrial Management that will open next fall in the former headquarters of Lever Brothers, has made an additional grant of $1,000,000 to the school.

Meetings and Elections

The **American Academy of Arts and Sciences** elected 84 new fellows at its annual meeting, bringing its membership to within three of its statutory limit of 1000. The following were elected foreign honorary members: Cornelius Gorter, Franz Eugen Simon, Karl von Frisch, James Bertram Collip, Geoffrey Crowther, Jaime Torres Bodet, and Alfonso Caso Andrade. Edwin H. Land, of the Polaroid Corporation, was re-elected president.

The **Bibliographical Society of America** elected Curt Buhler, of the Morgan Library, president at its meeting in May at the University of Virginia. He succeeds James Babb, of Yale. Clifton W. Barrett was elected treasurer and a member of the society's council.

Under the sponsorship of FAO and various government agencies, an **International Grassland Conference** will be held Aug. 17–23 at Pennsylvania State College. An Organizing Committee, under the chairmanship of P. V. Cardon, has invited 65 countries to participate and expects an attendance of approximately 2500 specialists. Four grassland tours of typical agricultural areas are being planned to follow the congress. Full information on the congress and tours may be obtained from the executive secretary, Room 1049, 1778 Pennsylvania Ave., N.W., Washington, D. C. The five previous grassland congresses have been held in Europe.

LOBUND Institute, University of Notre Dame, will hold a colloquium on "Studies on the Growth Effect of Antibiotics in Germ-free Animals" June 4. Thomas D. Luckey, James A. Reyniers, and Helmut A. Gordon will speak. Notify R. F. Ervin, of the Institute, of intention to attend.

The **Mississippi Academy of Sciences** elected Clay Lyle president, succeeding A. B. Lewis, and named C. E. Lane, Jr., president-elect. Clyde Q. Sheely was re-elected secretary-treasurer and executive officer, and C. B. Galloway was named editor. Nearly 200 registered for the Biloxi meeting.

New officers elected by the **North Carolina Academy of Science** are Otto Stuhlman, Jr., president; Reinard Harkema, vice president; and John Yarbrough, secretary-treasurer. A feature of the annual meeting was a symposium on "Genetics and Contemporary Problems." The 1951 Poteat Award was presented to Steve G. Boyce, of North Carolina State, for his paper on "Source of Atmospheric Salts." The 1953 spring meeting will be held at Raleigh.

The **Pan-American Union of Engineering Societies** (UPADI) will hold its third congress at Tulane University, New Orleans, Aug. 25–30, at which it is expected the organizational work begun in 1949 in Rio de Janeiro and continued in Havana in 1951 will be completed. Several delegates and observers plan to participate in the Centennial of Engineering in Chicago after the congress adjourns. Luis Giannattasio, of Montevideo, president of UPADI, will lead the meetings. James M. Todd, former president of the Engineers Joint Council and of the American Society of Mechanical Engineers, is in charge of arrangements in New Orleans.

A Symposium on the Dynamics of Growth Processes, sponsored by the Society for the Study of Development and Growth and the Committee on Developmental Biology of the National Research Council, will be held at Williams College June 26–29. Among the speakers will be L. M. Kozloff, L. Szilard, A. W. Pollister, G. Fankhauser, K. R. Porter, D. S. Van Fleet, F. W. Went, F. Skoog, R. Gaunt, W. W. Greulich, D. A. Sholl, G. E. Dickerson, and F. E. Smith.

Miscellaneous

The **American Medical Association** has established a Committee on Mental Health, to plan and develop operational programs and liaison relationships in the field of nervous and mental diseases. Leo Bartemeier has been named chairman, and Lauren H. Smith vice chairman. Other members include Walter H. Baer, Hugh T. Carmichael, Francis M. Forster, M. Ralph Kaufman, and Maurice Levine.

The Blakiston Company, which has published medical and scientific books in Philadelphia for more than 100 years, will move to 575 Madison Ave., New York, late this summer. The company will occupy offices with its parent organization, Doubleday & Co. Eunice Stevens has been appointed editor-in-chief, and James B. Lackey continues as science editor.

The following members of the 24-member National Science Board of the **National Science Foundation,** whose initial two-year terms expired on May 10, have been reappointed by President Truman for full six-year terms: Sophie D. Aberle, Robert P. Barnes, Chester I. Barnard, Detlev W. Bronk, Gerty T. Cori, Charles Dollard, Robert F. Loeb, and Andrey A. Potter.

Chemicals wanted by the **Registry of Rare Chemicals,** 35 W. 33rd St., Chicago 16, Ill., include calcium vanadate; sodium ferrate; diethyl arsenic bromide; zinc methionine; vinyl sulfonic acid; ethyl ortho carbonate; propargylic acid; piperolynic acid; 1,2,3,4-tetracarboxybutane; tetrahydrosylvan; tetrazolium violet; hexa-(*p*-biphenyl)ethane; 8-mercaptoquinoline; *n*-methyl acridone; 6-methyloctanoic acid; luminol; tropine; selachyl alcohol; scopine; and epicatechin.

Three publications of possible interest to American scientists are now available at H. M. Stationery Office, London, or at the British Information Services in New York: *Directory of Collections* [of microorganisms] *and List of Species maintained in the United Kingdom and the Crown Colonies; Selected Government Research Reports,* Vol. 3: *Protection and Electrodeposition of Metals*; and *Report of the Radio Research Board for the Year 1950.*

Association Affairs

Preliminary Announcement Sixth St. Louis Meeting

December 26–31, 1952

Raymond L. Taylor, Assistant Administrative Secretary

The 119th Meeting of the AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE—the annual meeting for the year 1952—promises to be one of the most significant meetings the AAAS has ever held. No organization that has grown each year until it now has 232 affiliates and nearly 50,000 individual members could hold an unimportant meeting, but this year certain programs will have especial significance in a time of tension and emergency. Consistent with the prime purposes for which it was founded more than 104 years ago, the Association's meeting will bring together leaders and younger men and women in every field of science, not only to read papers and discuss their specialties but also to attack some of the problems that affect science and the world today. Several of the programs, and particularly the general symposia, will merit the attention and attendance of all who can possibly journey to St. Louis.

At this year's meeting—which has as its theme "The Common Ground of Science, Mathematics, Engineering, and Industry," and which is officially recognized as the final event of the Centennial of Engineering—it is anticipated that there will be an increased attendance of engineers and industrial scientists meeting with scientists in other fields. At the same time, however, all 18 of the Association's sections and subsections have planned attractive programs of their own, and at least ten sections will have sessions for contributed papers. Some 30 societies have scheduled national meetings or regional sessions with the AAAS. The relative nearness of St. Louis to all large Midwestern institutions assures a good attendance from this great area but, as usual, no section of the United States and Canada will be unrepresented.

The Association will sponsor two general symposia that will equal, and may even surpass, those on "Soviet Science" and "Operation Knowledge" at last year's Philadelphia meeting. The first of these, scheduled for early in the meeting period, is "Disaster Recovery," first proposed by the AAAS Section M Committee, and adopted with enthusiasm by the AAAS Symposium Committee. In scope, its three or four sessions will deal with recovery from disasters of natural origin (floods, hurricanes), from large-scale industrial disasters, and from such disasters as wartime urban fire raids and atomic blasts. National and international authorities will be among the speakers; there will be a serious attempt to assess the common principles of the reactions and recovery of communities; and such aspects as emergency and health measures, law and order, psychology and morale, re-establishment of transport and communications, legal questions (identification of casualties, replacement of records), and rebuilding and city planning will be considered.

The second general symposium, which will comprise two sessions on December 30, will consider latest developments in "The Nation's Nutrition," from "soil to cytoplasm." Following an introductory examination of soils from a nutritional point of view, photosynthesis, and plant and animal food products, the larger part of the program will be concerned with the biochemistry of human nutrition, calorie requirements, protein requirements and amino acids, vitamins and trace bio-elements, and food processing and its effects. Howard B. Lewis, chairman of the Department of Biological Chemistry, University of Michigan, is program chairman.

The week's activities will center in the Henry W. Kiel Auditorium, within a few blocks of all downtown hotels. Here will be held the general symposia, some of the mathematical sessions, the sessions of the Oak Ridge Institute of Nuclear Studies, nearly all the sectional programs, the National Geographic Society's Annual Lecture, and the Biologists' Smoker. The physical relationships of the session rooms, the Main Registration, the Visible Directory of Registrants, the AAAS Science Theatre, and the Annual Exposition of Science and Industry, which will fill the Auditorium's Convention Hall, are almost ideal.

Hotels. The Jefferson Hotel will be AAAS Headquarters and will house the engineers and the physical and industrial scientists. It will be the locale of such evening events as the AAAS Presidential Address and Reception, December 28; the Sigma Xi Annual Address, December 29; and the Annual Address of the Scientific Research Society of America, December 30. The Statler will be headquarters for the Society of Systematic Zoology, the Herpetologists League, Alpha Epsilon Delta, and other medical and biological groups, including the botanists and the ecologists. The three science teaching societies, the National Association of Biology Teachers, the National Science Teachers Association, and the American Nature Study Society, will occupy the Hotel De Soto. The American Mathematical Society and the Mathematical Association of America, which are meeting with the AAAS for the first time since 1949, will hold most of their sessions on the campus of Washington University and will probably be housed in the Forest Park, Kingsway, and Roosevelt hotels. Among other hotels that have pledged sleeping accommodations at moderate rates are the Lennox, Mark Twain, and Mayfair (all convenient to the De Soto, Jefferson, Statler, and the Kiel Auditorium). Housing information and coupons for room reservations will appear in SCIENCE and THE SCIENTIFIC MONTHLY beginning about the end of July.

Advance registration. As in recent years, advance registrants will receive the General Program early

in December by first-class mail. Coupons will appear in the AAAS journals, beginning in late July. This year, the General Program will be simplified in format, its directory content will be increased, and, in response to an increasing demand, it will be made available to others not planning to attend.

The Programs

A—Mathematics

The *American Mathematical Society*, holding its national meeting with the AAAS, will have some 17 sessions for short contributed papers, three invited addresses, a business meeting, and a banquet. President J. Von Neumann will deliver his retiring address, and the Gibbs Lecture will be given by Marston Morse; both are in the Institute for Advanced Study. The national meeting of the *Mathematical Association of America* is scheduled for December 30. The vice-presidential address of the chairman of *AAAS Section A* will be given by R. L. Wilder, University of Michigan.

B—Physics

The *American Meteorological Society*, which will hold its 119th meeting with the AAAS, plans a number of sessions for contributed papers. The *Oak Ridge Institute of Nuclear Studies* will have two symposia: "Use of Radioisotopes in Industry," which will be cosponsored by Section B; and "Research Applications of Carbon 14;" ORINS will sponsor a luncheon the same day. The *St. Louis University Institute of Geophysics*, the American Meteorological Society, and the *American Geophysical Union* will cosponsor one or more symposia in geophysics (meteorology, seismology, hydrology). *AAAS Section B*, in addition to its cosponsorship of the radioisotopes symposium, will have a symposium on "Magnetic Resonance and its Applications;" at the physicists' dinner, Arthur H. Compton, Chancellor of Washington University, will give the vice-presidential address.

C—Chemistry

AAAS Section C has allotted two days for contributed papers in the principal fields of chemistry and the remaining four days for a series of symposia on medical and industrial chemistry.

D—Astronomy

The *American Astronomical Society* has not yet decided on its national meeting plans for 1952. The program of *AAAS Section D*, however, will include at least one technical symposium and a vice-presidential address by Harold L. Alden, Leander McCormick Observatory, University of Virginia.

E—Geology and Geography

The *Geological Society of America* and *AAAS Section E* will cosponsor sessions for contributed papers in general geology; a two-session symposium on "Modern Research of the State Geological Surveys and its Economic Values." This program of six papers, by as many state geologists, with six planned discussions, has been arranged by M. M. Leighton, chief, Illinois Geological Survey. There will also be a second symposium; and at a smoker, George W. White, University of Illinois, will give the vice-presidential address. Section E will also have two sessions for contributed papers in geography. The *National Speleological Society* plans a regional meeting. The *National Geographic Society* has scheduled its Annual Lecture for Monday evening, December 29.

F—Zoological Sciences

The *Society of Systematic Zoology*—with 1100 members, now one of the nation's largest zoological societies, concerned with all natural history phases of zoology—is holding its national meeting with the AAAS. In conjunction with *AAAS Section F* it will hold sessions for contributed papers in the mornings, book panels in the afternoons, and symposia of both technical and general interest in the evenings. The book panels will discuss two recent books on evolution and six recent texts in college biology and zoology; participants will include the authors and well-known zoologists, biochemists, psychologists, and paleontologists. Other zoological and science teaching societies will cosponsor appropriate sessions. The *Herpetologists League* will have a symposium on the common names of reptiles and amphibians of the United States, December 30.

FG—Zoological and Botanical Sciences

The *National Association of Biology Teachers*, for which this is the annual national meeting, will hold nine sessions and a luncheon over a five-day period, the last two days being devoted to the NABT Conservation Project. The *American Nature Study Society*, at its annual national meeting with the AAAS, will hold four days of sessions, including a symposium on the Nature Study Movement and panels on Nature Photography and Nature in Radio, Television, Press, and Magazines; President Roger Tory Peterson will preside. The *Ecological Society of America*, for which this is one of three regular meetings, will cosponsor the paper-reading sessions in plant and animal ecology of Sections F and G, a symposium on "The Western Range," of which F. W. Albertson, Fort Hays Kansas State College, is program chairman, and the *AAAS Section G* symposium "The American Midwest: I—The Cradle of Ecology; II—The Cradle of Conservation."

G—Botanical Sciences

In addition to the preceding symposium, *AAAS Section G* will have sessions for contributed papers in the principal fields of botany, a symposium in plant physiology cosponsored by the *Illinois and Purdue Chapters of the American Society of Plant Physiologists* and the *American Society of Naturalists*, arranged by Barry Commoner.

H—Anthropology

AAAS Section H has planned sessions for contributed papers, symposia on "New Developments in Southwestern Archaeology," "The Plains and the Rio Grande Pueblos," and, with Section K, a four-session symposium on "World Plans for Technical Assistance."

I—Psychology

AAAS Section I has scheduled sessions for contributed papers, a symposium on "Problems in Psychotherapy," and a two-session symposium, "Men and Machines," of which Philip H. Du Bois, Washington University, is program chairman. As usual, the vice-presidential addresses of Sections I and Q will be given jointly.

K—Social and Economic Sciences

AAAS Section K, in addition to the joint program with Section H, above, and with Section O, below, will hold a session on "Social Ecology," arranged by Amos Hawley, University of Michigan; will hold a joint session with the *American Statistical Association*; and

will cosponsor a symposium with the *National Academy of Economics and Political Science*. The National Social Science Honor Society, *Pi Gamma Mu*, will collaborate and will hold its annual luncheon.

L—History and Philosophy of Science

The *Philosophy of Science Association* plans five sessions. *AAAS Section L* will cosponsor some of these, certain programs of Sections F and G, and is arranging programs on the methodology of industrial research and on the history of science, cosponsored by the *History of Science Society*.

M—Engineering

AAAS Section M, which suggested and will assist with the Disaster Recovery general symposium, will have a six-session symposium on "Cooperation between Science, Engineering, and Industry;" will cosponsor a program being jointly arranged by the *St. Louis University Department of Engineering*, the *Washington University School of Engineering*, and the *Engineers' Club of St. Louis*; will cosponsor certain programs of AAAS Sections I, N, and P; and will cosponsor an important program on rail transportation, which will be arranged by the *Association of American Railroads*. Topics included are The Railroad Research Laboratory at the Illinois Institute of Technology, Scientific and Engineering Aspects of Central Traffic Control, Diesel Operation, and the Economics of Electrification vs. Dieselization.

N—Medical Sciences

The *American Psychiatric Association* is arranging a special program, under the direction of Jacob E. Finesinger, University of Maryland. *Alpha Epsilon Delta*, National Premedical Society, will hold its annual luncheon and is arranging a symposium. *AAAS Section N* is cosponsoring the symposia of Section I; the vice-presidential address will be given by William S. McCann, University of Rochester.

Nm—Medicine

AAAS Subsection Nm will have an exhibit on "Medicine and Instrumentation;" and will have symposia on "Industrial Hygiene and Toxicology," "Human Engineering," cosponsored by Section M, and another to be decided.

Nd—Dentistry

AAAS Subsection Nd will hold sessions for contributed papers and three symposia, "Scientific Aspects of Dental Filling Materials," "Engineering and Chemical Factors of Water Fluoridation," and "The Chemistry of Saliva;" there will also be a luncheon.

Np—Pharmacy

AAAS Subsection Np plans sessions for contributed papers from (*a*) pharmaceutical manufacturing firms, (*b*) accredited schools of pharmacy, and (*c*) pharmacy associations. It will have a symposium on "Newest Drug Therapy Agents." The *American Society of Hospital Pharmacists* and the *Scientific Section, American Pharmaceutical Association*, will cosponsor this program, of which George F. Archambault, U. S. Public Health Service, is chairman.

O—Agriculture

AAAS Section O, jointly with Section K, will have a four-session symposium on "Combined Resource Development with Special Reference to the Missouri Valley." The scope includes soils, vegetation, agriculture, minerals, hydrology, industrial development, investment, government. Charles E. Kellogg, chief, U. S. Soil Survey, program chairman, has received acceptances from distinguished authorities for each aspect; the treatment will be objective, with emphasis on scientific principles throughout.

P—Industrial Science

The *American Industrial Hygiene Association* will hold a regional meeting with the AAAS on December 30. The *Society for Industrial Microbiology*, for which this is one of two regular meetings, will hold six or more sessions. A symposium and conference of industrial microbiologists is being arranged by J. E. McClary, director of research, Anheuser-Busch, Inc., which will be cosponsored by *AAAS Section P*, the Society for Industrial Microbiology, the *Mycological Society of America*, and the *St. Louis Academy of Science*. The program of *AAAS Section P* is incomplete but is expected to surpass the excellent initial program.

Q—Education

AAAS Section Q will have sessions for contributed papers, symposia on "Contributions of Education to Engineering and Industry," "Contributions of Engineering and Industry to Education," and a panel on "The Regents Examination System in New York." The first session, "An Evaluation of the New York State Regents Examinations in Science," will be cosponsored by the *AAAS Cooperative Committee on the Teaching of Science and Mathematics* and the *National Science Teachers Association*. The Cooperative Committee will also sponsor a meeting on the topic "The Identification of Talented Youth in Science and Mathematics," and is joining with the National Science Teachers Association, the National Association of Biology Teachers, and the American Nature Study Society in sponsoring several sessions devoted to a consideration of effective techniques for implementing science teaching objectives at the various levels of instruction, special methods for dealing with slow and with rapid learners, and desirable characteristics of science textbooks. The National Science Teachers Association, holding its four-day national meeting with the AAAS, will have a series of sessions, including one on "Plans for the Future Scientists of America Foundation."

X—Science in General

The *Academy Conference*, with official delegates from most of the 38 academies of science affiliated with the AAAS, will hold two sessions devoted to round-table discussions of academy problems and a dinner; the retiring president, Clinton L. Baker, Southwestern College, will deliver an address on the history of the Academy Conference. The *St. Louis Academy of Science* will hold its December meeting with the AAAS. The *Conference on Scientific Manpower II* will hold sessions on three consecutive mornings on "Review and Assessment of Research on Scientific and Engineering Manpower," "Functions and Utilization of Rosters and Directories of Specialized Manpower," and "National Policies for Military Service." The program, under the chairmanship of Ralph M. Hogan, Human Resources Division, Office of Naval Research, will be cosponsored by the Engineering Manpower Commission and other agencies, including the AAAS Cooperative Committee. The *National Association of Science Writers* will hold its semiannual meeting with the AAAS and will have a program. The Annual Addresses or Lectures of the *National Geographic Society*, the *Scientific Research Society of America*, and the *Society of the Sigma Xi* have already been mentioned.

Technical Papers

A Possible Mechanism for the Nerve-blocking Action of *n*-Amyl Carbamate[1]

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This communication is a brief account of two experiments which suggest that in nerve block by *n*-amyl carbamate an interaction occurs which involves a sodium mechanism in nerve. The first experiment is summarized in Fig. 1. The sciatic-peroneal nerve of a bullfrog was removed and desheathed. The nerve was then placed in a moist chamber and mounted on silver-silver chloride stimulating and recording electrodes. The monophasic action potentials in the A group of fibers were then recorded oscillographically. In Fig. 1 the compound A spike height, in percentage, is plotted against the time, in minutes, in order to illustrate the course of events. Curve *A* shows that *n*-amyl carbamate (0.0055 *M*) made up in Ringer's solution, when added to a 20-mm segment of nerve between the stimulating and recording electrodes, did not reduce the spike height in 6 min. At 7 min, which is the zero time (*NA*) in the recovery curve (*A*) to the right, a solution containing 0.011 *M* NaCl and 0.099 *M* choline chloride was added to the nerve segment in place of the amyl carbamate–Ringer's solution. This caused only slight reduction of the A spike. It is known (unpublished observations in this laboratory) that a 0.011 *M* NaCl is able to maintain activity in most of the A fibers of the bullfrog sciatic-peroneal nerve. Curve *B* next illustrates the point that a 0.11 *M* choline chloride solution, with no NaCl, caused a rapid conduction block which was complete in 8 min. This block was due to the absence of sodium ions. Rapid recovery from this block occurred when a solution of 0.011 *M* NaCl and 0.099 *M* choline chloride was added to the nerve segment at the time indicated as *NA*.

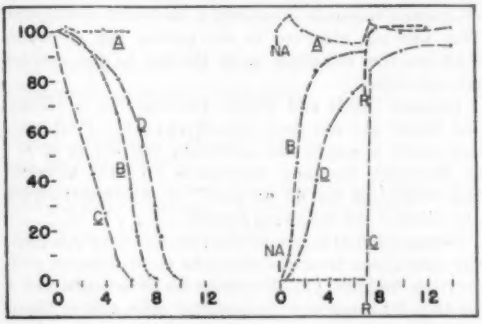

FIG. 1. Height of A potential, in percentage vs time in min. Curves on left represent action, curves on right are of recovery. *R* indicates replacement of test solution with Ringer's solution. *NA* indicates moment of addition of 0.011 *M* NaCl.

Curve *C* represents the significant section of the experiment. It shows that very rapid block was produced by a NaCl-free solution of 0.0055 *M* amyl carbamate in 0.11 *M* choline chloride. Thus a concentration of amyl carbamate, which in Ringer's solution was ineffective (Curve *A*), produced a facilitation of block when it was employed in the sodium-free solution. Upon the addition of a solution of 0.011 *M* NaCl and 0.099 *M* choline chloride in place of the amyl carbamate solution, no recovery took place until Ringer's fluid was added at the seventh minute of the recovery portion of Curve *C*. Complete inhibition of recovery by the ordinarily effective 0.011 *M* NaCl was obtained. The data for Curve *D* were next obtained. This was a repetition of the *B* section of the experiment and was carried out in order to show that the carbamate action was reversible and that the effect shown in Curve *C* was not due to a temporal deterioration of the nerve preparation.

The experiment of Fig. 1 illustrates an inhibitory action of *n*-amyl carbamate on the process of recovery by 0.011 *M* NaCl. It is also possible to demonstrate the converse effect—i.e., an inhibition of the amyl carbamate–blocking action by sodium ions. The effect is summarized in Fig. 2. Curve *A* illustrates the point that a 0.022 *M* NaCl solution, with sucrose serving as the osmotic substitute for the deficient NaCl, had no

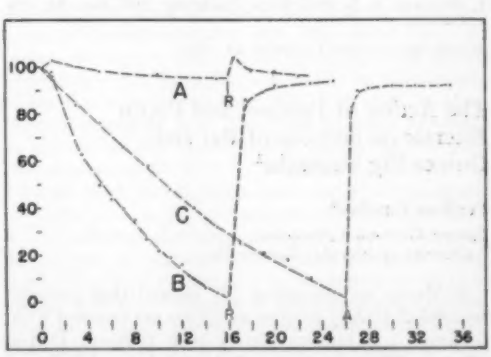

FIG. 2. Plot of A potential vs time (min). Curve *A*, lack of action by a solution of 0.022 *M* NaCl and 0.18 *M* sucrose. Curve *B*, block by a solution of amyl carbamate (0.0047 *M*), NaCl (0.022 *M*), and sucrose (0.18 *M*). Ringer's solution was added at moment indicated by *R*. Curve *C*, block by same test solution as in Curve *B*. At moment indicated by letter *A*, a solution of amyl carbamate (0.0047 *M*) and NaCl (0.11 *M*) replaced the test solution. Data for Curves *A* and *B* were obtained on one nerve, and Curve *C* data were obtained on the mate nerve. All solutions contained, besides the substances indicated, $CaCl_2$, KCl, and phosphate buffer as in Ringer's solution. The pH was 7.2–7.3, and the temperature of the bath for the nerve chamber was 23.5° C ± 0.5.

[1] Aided by a grant from the Division of Research Grants and Fellowships, National Institutes of Health, U. S. Public Health Service, and by a grant from the Board of Research, University of California.

[2] With the technical assistance of Robert J. Dellenback.

significant action on the compound A spike of the desheathed sciatic-peroneal nerve of the bullfrog. Many experiments in this laboratory have shown that this concentration of NaCl is more than sufficient to maintain conduction in the A group of fibers in the bullfrog sciatic nerve. Curve *B* shows the rapid conduction block in the A fibers by a solution containing 0.0047 *M* amyl carbamate and 0.022 *M* NaCl. Addition of Ringer's solution at 16 min in place of the test solution caused a rapid return of the A activity. The crucial segment of the experiment is shown as Curve *C*. This illustrates the conduction block by a solution of 0.0047 *M* amyl carbamate and 0.022 *M* NaCl. At 26 min, when nearly complete block was achieved, the amyl carbamate solution was replaced by a second solution containing again 0.0047 *M* amyl carbamate but with the NaCl increased to 0.11 *M*. This caused a rapid recovery of conduction at a rate which was certainly no less than that of the previous run (Curve *B*). The experiment clearly demonstrates the reversal of block in the presence of amyl carbamate by increased sodium concentration.

Both types of experiments (Figs. 1 and 2) were simple, conclusive, and repeatable at will. The results suggest the existence of an intimate interaction between amyl carbamate and sodium. Present experiments, now in progress, suggest that other nerve-blocking drugs behave in a similar manner. The experiments, although subject to several interpretations, are most simply explained in the light of present knowledge on the assumption that amyl carbamate interferes, directly or indirectly, with a sodium mechanism. The experiments are of especial interest in relation to the sodium hypothesis of nerve conduction (*1*).

Reference

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Manuscript received December 24, 1951.

The Action of Pectinol and Pectin Esterase on Sections of Rat and Guinea Pig Stomachs[1]

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McManus and Saunders (*1*) showed that periodic acid-Schiff (PAS) positive materials are removed with pectinase and less completely with pectinol. Pectin esterase did not remove these substances, but enhanced the PAS-coloration. The authors used human tissues (colon, bronchial mucins, and kidney) for their investigations. An attempt to compare the action of pectinol and pectin esterase on the stomach of the albino rat and of the guinea pig seemed of interest.

[1] This investigation was supported by Research Grant C-976 from the National Cancer Institute of the National Institutes of Health, U. S. Public Health Service.
[2] With the technical assistance of Dorothy Sawicki.

Ten 2–8-month-old nontreated rats of the Sprague-Dawley-Holtzman strain and 10 approximately 2-month-old nontreated guinea pigs (Rockland Farms) were killed by neckstroke. Their glandular stomachs were cut into 3 zones according to our standard procedure (*2*) and fixed in chilled ethanol, dehydrated, cleared in amyl acetate in the cold room at 4° C, and vacuum-embedded. Sections of 6μ thickness were mounted on slides with glycerine egg albumin, and left in a 50° C oven overnight. This step insured the adherence of the sections to the slides during incubation with the enzymes. The PAS-reaction (*3*) was carried out alone or after incubation of the sections with various enzymes.

The McManus reaction revealed PAS-positive fiber-like materials in the muscularis mucosae of the rat stomach. Those lying between the mucosa and the muscularis mucosae simulated a basement membrane. This was not observed in the guinea pig, in which PAS-positive materials were limited to the surface mucous cells.

Pectinol 100-D and Pectin Esterase No. 5 (Rohm and Haas) did not show any effect on the PAS-reaction at 1% strength and incubation for 30 min at 37° C. However, the same substances at 0.4% strength and incubation for 48 hr at 37° C, as recommended (*1*), showed the following results.

Pectinol 100-D incompletely removed the PAS-positive substances from the stomachs in accordance with previous findings (*1*). Furthermore, it brought out a positive PAS-reaction in parietal cells and erythrocytes that did not appear with the PAS-reaction alone or after saliva, ptyalin, or Taka-diastase incubations. Pectin esterase, also in accordance with McManus and Saunders (*1*), did not remove PAS-positive materials. It not only enhanced the coloration in the known PAS-positive constituents of the stomach, but caused a deep PAS-coloration in parietal and squamous cells, muscularis mucosae, submucosa, muscularis, and the walls of all blood vessels and erythrocytes. This was noted in the rat with greater intensity than in the guinea pig.

Incubation of rat stomach sections with Pectinol 100-D and Pectin esterase No. 5 at 37° C for 8 hr, followed by an accidental exposure to 60° C for 15 hr, gave the same results. Rat and guinea pig slides incubated with the same enzymes for only 8 hr at 37° C showed identical results. This demonstrated that 8 hr of incubation sufficed for the enzymatic action; furthermore, that a 15-hr incubation at 60° C did not affect the actions once they had taken place, although pectinases are rapidly inactivated at 60° C (*4, 5*).

After an 8-hr pectin esterase incubation, followed by a 15-hr pectinol incubation, less PAS-positive materials were observed than after pectin esterase incubation alone. This proved that pectinol removes some of the PAS-positive materials, whereas pectin esterase broke down PAS-negative mucoproteins into simpler PAS-positive cleavage products. Differences were noted here between the rat and the guinea pig. In the rat, less PAS-positive substances were removed by

pectinol. Furthermore, the PAS-positive basement membranelike structures were not affected. This showed that the rat stomach, in contrast to the guinea pig stomach, contained PAS-positive materials that were unaffected by pectinol following pectin esterase.

The results indicate a difference in the distribution and the chemical composition of mucoproteins and mucins in the stomach walls of the two species.

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Manuscript received December 13, 1951.

The Preparation of Wet Ashed Tissues for Liquid Counting[1]

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The wet ashing of animal tissues with hot concentrated nitric acid usually leaves a small amount of fatty material undissolved. Comar (*1*) found in the course of extensive studies on the distribution of Cu^{64} and Mo^{99} that the amount of radioactive material contained in the fatty residue was negligible and that no significant error was produced by removing the fatty layer and discarding it. However, we found that the radioactivity of Hf^{181} and Au^{198} in the fatty material cannot be overlooked, since in some instances the counts per gram of undissolved fatty material were nearly ten times those of the aqueous solution (*cf.* 1 and 2, Table 1). The small amount of undissolved fat[3] in the digestion of the liver of a dog which had received Au^{198} in colloidal form was found to contain over 15% of the total activity of that organ.

The presence of relatively high activity in the fatty layer makes it difficult to obtain a representative aliquot portion for counting unless special precautions are observed. The fatty material tends to rise to the top of the mixture, and as a result the first sample poured off contains a higher proportion of this material than subsequent samples, whereas a sample of aqueous layer taken by pipette involves the opposite error (*cf.* 3 and 4, Table 1).

Since the fatty layer tends to float on top of the water layer, the radiation is not absorbed to the same extent as when the radioactive element is distributed uniformly. In cases where the thin floating layer has a higher specific activity than the water layer it causes too high a count. This effect has been noted when only a thin fatty film was visible on the surface of the liquid in the counting dish. The addition of a pinch of detergent (e.g., Tide) and agitation to break up the surface film have served to reduce the counting rate as much as 30–50% (*cf.* 5 and 6, Table 1).

In the past, investigators have sometimes dissolved the fatty layer in organic solvents such as amyl alcohol or ether-alcohol mixtures and counted aliquot portions of the aqueous and organic solutions separately (*2*). We have found it more convenient to add enough acetone or dioxane to bring both the fat and water into a single phase. The procedure is as follows: The entire organ or a representative sample of the minced organ was heated with a minimum amount of concentrated nitric acid until all particulate matter was dissolved and most of the excess acid had been boiled away;[4] the solution was cooled and diluted with acetone or dioxane and a little water to form a clear

TABLE 1

Example*	Specimen digested	Entire specimen diluted to	Sample counted	(Counts/min) $\times 10^{-3}$
1	Carcass†	1000 ml	10 ml aqueous phase	1.07
			10 g fat	10.3
2	Carcass†	1000 "	10 ml aqueous phase	0.12
			10 g fat	.96
3	Carcass†	1000 "	10 ml clear aqueous phase (not containing fat droplets)	.47
			10 ml after shaking (fat droplets included)	.76
4	Liver†	250 "	First 10 ml poured off (containing much fat)	8.47
			Second 10 ml poured off (containing less fat)	1.65
			Third 10 ml emulsified with Dreft	.35
5	Kidney‡	10 "	Entire 10 ml	5.78
			Same sample, after emulsification with Tide	2.41
6	Liver§ 0.59 g	10 "	Entire 10 ml	1.77
			Same sample, after emulsification with Tide	1.29

* Each example refers to a different animal.
† Of rat which had received injection of Hf^{181} sodium catechol disulfonate complex.
‡ Of rat which had received injection of Hf^{181} sodium gluconate complex.
§ Of rat which had received injection of Hf^{181} sodium mandelate complex.

[1] This work was done at the Medical Division Oak Ridge Institute of Nuclear Studies, Oak Ridge, Tenn.
[2] Present address: Mechelininkatu 29A19, Helsinki, Finland.
[3] The term "fat" is used loosely in this paper to refer to the fatlike material which remained undissolved after acid digestion. It is doubtful that the animal fat, before digestion, contained a high level of radioactive material.
[4] At this point a small amount of concentrated HCl is added to samples containing colloidal gold, to prevent the adsorption of radioactivity on the walls of the container. In the absence of HCl the loss of Au^{198} may amount to as much as 25% in 24 hr and more on longer standing.

solution of known volume. The optimum mixture contains 60–80% acetone or dioxane, the exact proportion depending upon the relative amounts of fat and inorganic salts in the sample. If more than one dilution is made, it is economical to use acetone for the first dilution. However, because of its higher boiling point and density, dioxane[5] is to be preferred for the final dilution if the sample is to be counted as a liquid. In a few instances the mixing of acetone with concentrated nitric acid solutions was followed by evolution of heat and boiling of the acetone, which caused loss of sample. This difficulty was not encountered when dioxane was used for all the dilutions.

Using the above method we have been able to obtain good results with Au^{198} as well as with Hf^{181}. We were able to recover approximately 95% of radioactive colloidal gold added to a whole rat and to a dog liver before digestion. In another experiment the total activity found in a whole dog liver by this method differed less than 3% from the total activity found by counting the aqueous and fatty layers separately.

The use of acetone or dioxane to make a homogeneous nitric acid tissue digest is recommended as a more accurate and simple method for the determination of the isotope content of animal tissues.

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1. Comar, C. L. Private communication.
2. ———. *Nucleonics*, **3**, (3), 32 (1948).

[5] Dioxane should be handled with due precautions in view of its inflammability, the toxicity of its vapors, and the possible presence of explosive peroxides.

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Effect of Ascorbic Acid on the Adrenal Weight of Normal and Hypophysectomized Rats[1]

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Ascorbic acid, in large doses, has been reported to increase the fall in adrenal cholesterol and to have other ACTH-like effects (*1–3*). It has also been shown that the same substance prevents the normal hypertrophy of the adrenals in animals exposed to cold (*4*), as well as the alarm reaction in the same conditions of exposure (*1*) or under epinephrine treatment (*5*). In the case of exposure to cold, ascorbic acid also increased the survival of the animals (*4*).

The purpose of the present investigation was to try to clarify and correlate the above findings. At least three working hypotheses might explain why ascorbic acid prevented the normal hypertrophy of the adrenals during stress: (1) ascorbic acid may inhibit directly the action of ACTH on the adrenal, although this seemed rather unlikely; (2) it has a corticotrophic effect; the hypersecretion of cortical hormones thus produced (an assertion substantiated by the fact that the fall in adrenal cholesterol is greater with, than without, ascorbic acid during exposure to cold [*1*]) would prevent, indirectly, the hypersecretion of ACTH, according to Sayer's theory (*6*); or (3) that ascorbic acid has a potentiating action on ACTH when the demand for cortical hormones increases. If the last possibility is correct, one would expect that in a case of stress the hypophysis would not be hyperstimulated by the lack of cortical hormones, which are produced in sufficient amount by the combined action of small doses (approximately corresponding to normal secretion) of ACTH and ascorbic acid.

Consequently, three series of experiments were performed. In the first, we wanted to learn whether ascorbic acid prevents the action of injected ACTH on the adrenals of normal rats. Sixty rats, averaging 200 g in weight, and fed Purina Fox-Chow *ad lib.*, were divided into 4 groups: One group (A) received by daily intraperitoneal injection, during 3 days, 150 mg of sodium ascorbate; a second group (B) received the same amount of sodium ascorbate plus 10 mg daily of ACTH by intramuscular injection; a third group (C) received sodium bicarbonate intraperitoneally, the amount of sodium injected daily being equivalent to that injected into the first group; and the last group (D) received sodium bicarbonate intraperitoneally plus 10 mg/day of ACTH by intramuscular injections. The results, presented in Table 1, show that ascorbic acid does not prevent the action of injected ACTH. The increases in adrenal weight in the ascorbate and bicarbonate groups are both statistically significant and do not differ from one another.

The second and third series of experiments were done on hypophysectomized rats, fed the special diet of Shaw and Greep (*7*). In each case, the left adrenal was removed 10 days after hypophysectomy and before any treatment. Comparisons were then made on each individual between the right adrenal after treatment, and the left one before treatment. Table 2 shows that ascorbic acid has no effect on the adrenal weight of hypophysectomized animals, at least for the 10-day period of treatment we have used.

In the third series of experiments, we tried the effect of a small dose of ACTH (0.5 mg/day) combined with ascorbic acid. Both were given by intraperitoneal injection. The dose of ACTH employed had no effect by itself on the adrenal weight, nor did the combination of ACTH (same dose) and bicarbonate (solution adjusted so as to inject the same amount of sodium daily into this group as into the sodium ascorbate group) have any effect; but the combination of the same dose of ACTH with ascorbic acid (150 mg/day) had a pronounced and significant effect. Whereas there is a small decrease in the first two groups (Table 3) between the weights of the right adrenal after treatment as indicated and the left adrenal before treatment, there is, on the contrary, an

[1] This work is part of a project supported by the Defence Research Board of Canada.

[2] Research fellow from the Canadian Life Insurance Officers Association.

TABLE 1

INFLUENCE OF ACTH ALONE AND OF ACTH COMBINED WITH ASCORBIC ACID ON THE ADRENAL WEIGHT OF NORMAL RATS

Group	No. of animals	Treatment	Days of treatment	Adrenal wt* (mg)	Diff (%)	t
A	14	150 mg daily of sodium ascorbate intraperitoneally	3	34.94 ± 1.19†		
B	16	150 mg daily of sodium ascorbate intraperitoneally + 10 mg daily ACTH intramuscularly	3	40.24 ± 1.30	15.2	3.01
C	14	$NaHCO_3$ intraperitoneally; Na equivalent to A	3	35.21 ± 1.38		
D	16	$NaHCO_3$ intraperitoneally and 10 mg ACTH daily intramuscularly	3	41.03 ± 1.33	16.5	3.04

* Fresh weights.
† Standard error.

TABLE 2

EFFECTS OF ASCORBIC ACID ON THE WEIGHT OF THE RIGHT ADRENAL OF THE HYPOPHYSECTOMIZED RAT

Treatment	Duration of the experiment after hypophysectomy (days)	Days of treatment	No. of animals	Adrenal wt* (mg)		Diff (%)
				Left	Right	
$NaHCO_3$ Na equivalent to the other group, intraperitoneal injections	20	10	19	5.89	6.36	7.9
150 mg daily of Na ascorbate, intraperitoneal injections	20	10	19	5.94	5.98	0.6

* Fresh weights.

important and very significant increase in adrenal weight (right compared to left; increase of 25%, $t = 3.61$) in those hypophysectomized animals receiving daily for 10 days, 0.5 mg ACTH and 150 mg ascorbic acid, in the form of sodium ascorbate.

That the sodium had nothing to do with the phenomenon is clear from the fact that controls receiving sodium bicarbonate plus the same amount of

TABLE 3

INFLUENCE OF ASCORBIC ACID COMBINED WITH ACTH AND OF ACTH ALONE ON THE ADRENAL WEIGHT OF THE HYPOPHYSECTOMIZED RAT

Treatment	Duration of experiment after hypophysectomy (days)	Days of treatment	No. of animals	Adrenal wt* (mg)		Absolute diff (mg)	Diff (%) between right and left adrenal
				Left	Right		
ACTH, 0.5 mg/day intraperitoneally	25	10	19	5.99 ± 0.32†	5.73 ± 0.42	−0.26	
$NaHCO_3$ + ACTH, 0.5 mg/day intraperitoneally	25	10	10	5.53 ± 0.23	5.28 ± 0.25	−0.25	
Na Ascorbate, 150 mg/day + ACTH, 0.5 mg/day intraperitoneally	25	10	21	5.79 ± 0.20	7.27 ± 0.36	+1.48	+25.6 ($t = 3.61$)
Diff (%) between weight of right adrenals					Between 1 and 3 26.9% ($t = 2.79$)	Between 2 and 3 37.7% ($t = 4.54$)	

* Fresh weights.
† Standard error.

ACTH showed a slight decrease in weight of the right as compared to the left adrenal, instead of a significant increase.

Histological studies were also made on the same adrenals and will be published separately (*8*). Let it suffice to say here that, as far as the fall in cholesterol and the measures (with a planimeter) of the different zones of the adrenal cortex are concerned, the results parallel exactly the ones that we have just described for the adrenal weight.

Such a result may mean that a *normal* secretion of ACTH, plus large doses of ascorbic acid, has the same effects as much larger doses of ACTH alone, when the doses correspond to hypersecretions in normal animals submitted to stress.

The fact, just described, that ascorbic acid synergizes the action of ACTH, at least in hypophysectomized animals, seems to contradict the alternative that ascorbic acid prevents the hypertrophy of the adrenals in a case of stress. But the conditions of both experiments were not the same, and, moreover, we do not know yet if the potentiating action of ACTH by ascorbic acid is quantitatively the same, whether we consider the effect on adrenal weight (AWF) or on the cholesterol fall of the adrenals. In other words, it is possible that small doses of ACTH plus ascorbic acid, which would have the same effects on the fall of adrenal cholesterol as larger doses of ACTH alone, would have a slower or less intense effect than the same doses of ACTH alone on the adrenal weight.

One might also wonder why there is such a great difference in the dosage of ACTH between the first and the third series of experiments. The reason is that, in the first series, we wanted to learn whether ascorbic acid prevented the action of ACTH, when ACTH was actually present, and we wanted to be sure to obtain the action of ACTH within 3 days; but we did not use the same dosage of ACTH for the third series, because there we wanted to show that a small dosage of ACTH would have a stimulating effect on the adrenal weight only if combined with ascorbic acid, a result which would necessarily have been masked by large dosages of ACTH.

From these experiments it may be concluded that (1) in normal rats, ascorbic acid does not prevent the action of injected ACTH on the adrenal weight; and (2) in hypophysectomized rats, ascorbic acid alone has no effect on the regeneration of the adrenal cortex but potentiates the effects of ACTH on the same process.

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The Interaction of Hyaluronidase with Thromboplastic Components of Blood Coagulation

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Although it is known that the activity of hyaluronidase may be inhibited by normal mammalian sera (*1*), no attention seems to have been paid so far to the interaction of hyaluronidase with the clotting mechanism of plasma. During investigations of the first stage of the blood clotting process (activation of prothrombin) it was noted that the plasma thromboplastic material is affected by dialyzed bovine hyaluronidase. Fig. 1 summarizes the observations showing the clot-inhibitory effect of hyaluronidase on human oxalated plasma after 10 min incubation at 38° C. Enzyme heated to 60° for 15 min has no activity. Incubation of plasma with the enzyme did not affect the prothrombin time (Quick's one-stage) indicating that prothrombin, labile factor (Ac-Globulin), and fibrinogen were not attacked by the hyaluronidase. This restoration of the coagulability of the incubated plasma-enzyme mixture suggested that the enzyme was acting against a thromboplastic component. In agreement with this, it was found that the inactivating effect of the enzyme could also be corrected by the addition of washed, isolated, human platelets. If, however, the platelets were first incubated with

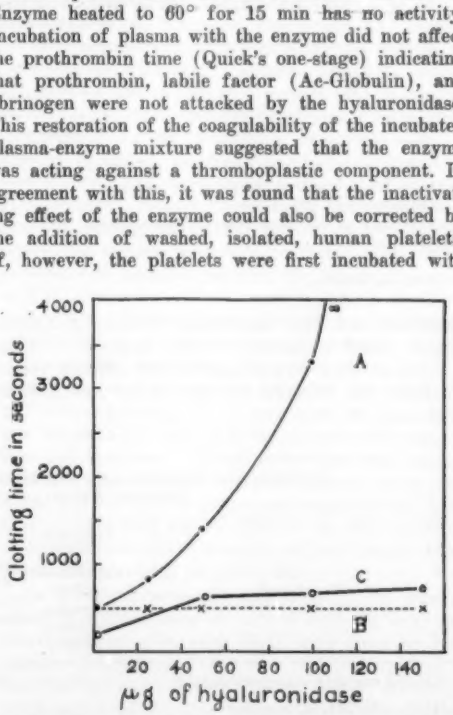

Fig. 1. The effect of dialyzed (48 hr, against saline) bovine hyaluronidase (Armour) on the clotting time of human oxalated plasma. Plasma-enzyme mixture incubated at 38° C for 10 min; pH, 7.5. After incubation, plasma recalcified with 0.25 *M* $CaCl_2$. Curve *A*, plasma incubated with active enzyme; Curve *B*, incubated with enzyme heated to 60° C for 15 min; Curve *C*, after incubation of plasma with enzyme, 0.1 ml isolated, washed, human platelets (5×10^5 mm^3) were added to 1.0 ml of the incubated mixture. The prothrombin time of the unincubated control was 14.6 sec. Addition of 0.2 ml rabbit brain thromboplastin (acetone-dried) to all incubated recalcified plasma-enzyme mixtures restored coagulation in 14.8 sec.

TABLE 1

PROTECTION OF HUMAN PLASMA AGAINST THE EFFECT OF HYALURONIDASE BY DIFFERENT CONCENTRATIONS OF PLATELETS*

Amount of platelets (in mm³ of added suspension)	0	1×10^5	2.5×10^5	5×10^5	2×10^6
Clotting time of platelet-plasma mixture	177 sec	94 sec	85 sec	85 sec	82 sec
Clotting time of platelets-hyaluronidase-plasma mixture	∞	> 1000 "	820 "	450 "	197 "
Prothrombin time of platelets-hyaluronidase-plasma mixture (after addition of 0.2 ml brain thromboplastin)	10.1 sec	10.2 "			10.1 "

* Five tenths ml of platelet suspension incubated for 30 min at 38° C with 1 mg dialyzed bovine hyaluronidase. After incubation, 0.5 ml human oxalated, dialyzed plasma was added to each sample and incubated for 10 min. Recalcified with 0.5 ml $CaCl_2$ (0.02 *M*), pH 7.5.

hyaluronidase, their clot-accelerating activity was overcome and the enzyme retained less activity (or none) against the plasma (Table 1). The enzyme, counteracted by an excess of tissue (brain) thromboplastin, could inhibit the diluted thromboplastin (1:100–1:1000), so that in respect to hyaluronidase inhibition the same factor appears present in both tissue and platelet thromboplastic component.

The enzyme after its incubation with plasma could not be recovered. There is, moreover, some evidence that the effect of clotting inhibition by even small amounts of hyaluronidase is not dependent on the incubation time. Thus it seems likely that, rather than providing a substrate in the conventional sense, the thromboplastic component both in plasma (from the platelet material still present) and in platelets interact with the enzyme competitively, with resulting inhibition of the plasma clotting mechanism and of hyaluronidase, one or the other inhibition being more in the foreground, depending upon the relative excess of either hyaluronidase or platelet material.

So far as platelets are concerned, it was found that these elements do not contain any measurable amount of nucleic acid (UV-spectra of sonically disrupted platelets) but, in addition to protein material absorbing at 280 mμ and inactive in coagulation, they do contain material that competes with hyaluronidase, withstands boiling for 15 min, and is not precipitated by 5% trichloracetic acid. This nonprotein material which does not pass through the cellophane dialysis membrane has the same accelerating effect on the coagulation as the intact platelets. The chemical nature of this thermostable, nonprotein thromboplastic material, which interacts with hyaluronidase in the same manner as described above, and which corresponds to what has been designated by Howell (*2*) as "cephalin" thromboplastic factor, is under investigation by means of paper chromatography. In connection with the inhibitory effect of hyaluronidase on thromboplastic blood component the further purification of enzyme preparations is needed. It may be recalled, also, that the thromboplastic effect of highly polymerized hyaluronic acid has been reported (*3*).

Although the concept of the interaction of platelets and a plasmatic factor in constituting the natural thromboplastin in blood coagulation is fully valid, the particular formulation of Quick (*4*), supposing the active principle in platelets to be an enzyme (thromboplastinogenase), is incompatible with the findings here reported, which exclude the protein nature of the thromboplastic platelet factor. A detailed study of the thromboplastic system operating in blood will appear shortly.

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A Tissue Chamber and Splint for the Mouse[1]

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Technical problems of splint and chamber construction encountered while engaged in tissue chamber studies of skin grafts in mice prompted some experimentation. A type of splint was devised which could be constructed from copper wire, sheet lucite, and solder with the aid of a few tools. It is offered to those who wish to undertake this fundamental mode of animal experimentation, but who have little machine-shop aid, and whose laboratory time is limited. It is well tolerated (4 weeks or longer) and satisfies the basic requirements of (1) adequate immobilization and protection, (2) maintenance of proper circulation within the chamber, and (3) provision for satisfactory microscopic observation. It has been used successfully in conducting several series of studies of skin grafts in mice.

Although the essential principles of construction described in detail by Algire and Legallais (*1*) have been followed, the skin flap is immobilized with a traction splint of copper wire, and the tissue chamber proper is incorporated within one of the lateral splints of lucite. The chamber itself is closely similar to the

[1] This work aided by U. S. Public Health Service Grant No. H-466.

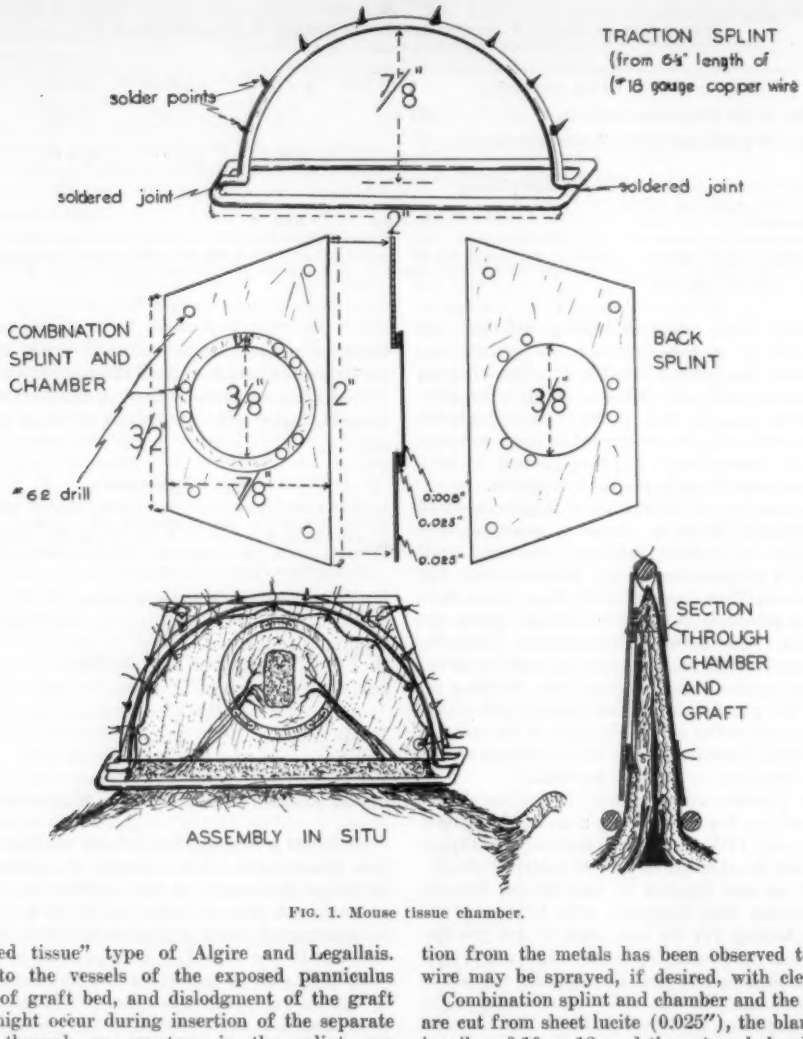

FIG. 1. Mouse tissue chamber.

"preformed tissue" type of Algire and Legallais. Trauma to the vessels of the exposed panniculus carnosus of graft bed, and dislodgment of the graft such as might occur during insertion of the separate chamber through an aperture in the splint, are avoided; splint and chamber are placed over the wound, the edges of which are then gently teased around it, without damage to either graft or bed.

Construction of splint and chamber. A traction splint of copper wire (18-gauge, bare) is made by bending a 6½" length around a wooden or lucite semicircular block of dimensions as shown (Fig. 1), which is grooved shallowly to hold the wire in position. The splint is soldered at the places indicated. Drops of solder are applied to the well-burnished wire ("flowed on") and then pulled out to points by touching them with the iron as it cools. The points prevent slipping of the tantalum wire (0.003") traction sutures along the wire arch. Although no irritation from the metals has been observed to date, the wire may be sprayed, if desired, with clear lacquer.

Combination splint and chamber and the back splint are cut from sheet lucite (0.025"), the blanks stacked in piles of 10 or 12, and the suture holes drilled with a #62 drill. The circular apertures of both splints are cut out with a ⅜" wood gouge. The windows for the chamber are cut from thinner sheet lucite (0.008") with a punch made from brass tubing (⅝"). The supporting rings for the chamber are either made from a tube of lucite, turned and drilled on a lathe to size and rings cut therefrom with the small circular saw of the drill kit, or are cut out with gouge and punch from 0.025" sheet lucite.

Splint, ring, and window are then cemented together with lucite cement (5% solution of lucite in chloroform) to form the combination splint and chamber, and placed under pressure for several hours to insure firm union. The 6 holes for the chamber sutures are

then drilled (#62 drill or smaller, depending upon size of needle to be used). All sharp edges around the chamber are removed with a fine file or sandpaper.

The lower figures of the illustration show the lateral and cross-sectional views of splints and chamber in position on the mouse, the graft resting on the panniculus carnosus beneath the transparent chamber.

Operative procedure: Time is saved if anesthesia is induced with ether, immediately supplemented with 0.2 ml (1.2 mg) of a 1:10 dilution of Veterinary Nembutal. Clipping and depilation (with depilatory cream) may then be done without delay. A wooden or lucite block (3″ × 2″) provided with a V-groove is used to hold the mouse in position during passage of sutures, skin dissection, and fixation of the chamber.

The four arteries of the skin of the dorsum being identified by transillumination, they are apposed, and the fold of skin transfixed with a suture at the highest point of the skin fold, or seized with towel forceps, which enclose the wire arch also, at this same point. Fixation sutures are then passed through the periphery of the skin fold, and fastened by twisting with serrafin clamp or by tying. If the very small arterial needles (#16 Diamond drill-eyed sharps) are not available, #9 Milliner's may be used. The base of the traction splint may be given additional anchorage by passing sutures through it and the skin, at its two ends.

Should loss of proper flap tension or loosening of sutures occur, additional or replacement sutures are readily placed where needed, with this type of splint.

The fold of skin being fixed in traction, graft bed and chamber site are prepared as follows: At the center of the proposed chamber site, the skin is carefully nicked with fine scissors and, by blunt dissection, gently raised in radial fashion from the underlying panniculus carnosus. This procedure is facilitated if an initial bleb of skin is raised by injection of a drop of saline with a very fine hypodermic needle. The separation of skin from panniculus completed, the skin is removed so as to leave a circular wound of approximately the same diameter as that of the chamber (*2*). During this procedure damage to the vascular panniculus must be scrupulously avoided. Only one skin layer is treated in this fashion, its panniculus being the bed of the graft. The opposite skin layer and panniculus are preserved intact.

Splint and chamber are then placed over the circular opening, and over the graft (if used). The back splint is then applied, and sutures are passed through both splints and around the wire traction splint, as shown. The three through-and-through sutures of the chamber are then passed and tied after making sure that the chamber is lying upon the panniculus, and within the edge of the skin wound. A seal of fibrin from the exudate soon cements the outer edge of the chamber to the edge of the circular incision.

Materials required are sheet lucite: 0.025″ and 0.008″; lucite cement: 5% lucite in chloroform; copper wire: 18-gauge, bare; solder: resin core.

Tools required are drill press: "Handee," "Casco," etc.; drill: #62 (64); circular saw blade for drill; soldering iron: "pistol type" preferred, with fine tip; pliers: one long-nosed, one side-cutting; bench-vise: small; shears or heavy scissors; wood gouges: ⅜″ and ⅝″; brass tubing: ⅝″ ID; small files; fine sandpaper.

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A Variable Heart Pump Permitting Independent Control of Rate, Output, and Ejection Velocity

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Since the cardiovascular apparatus is an integrated system, it is often difficult to differentiate between purely cardiac and purely vascular responses. One approach to the understanding of the functioning of a complex system is to isolate its various parts. In this way the responses of each segment may be studied under controlled conditions undistorted by the reactions of the other parts. A great advance was made by Starling (*1*) who, utilizing the living heart and lungs, substituted an artificial vascular system which could be altered at will. Starling thus was able to analyze the effects on the heart alone of controlled variations in venous return, temperature, and peripheral resistance. However, the reverse experiment, that of studying the reactions of the isolated vascular system in response to controlled variations in the cardiac pumping mechanism, has not yet been undertaken.

Recent advances, particularly the development of plastics which do not interfere with the coagulability of the blood, have made it possible to construct a workable "artificial heart" (*2, 3*). It seems possible, therefore, to develop a heart pump that can be altered at will over a wide range in regard to rate, output, and ejectile velocity and to substitute this pump for the living heart in the experimental animal. A means would thus be provided for studying the effects of controlled variations in the cardiac pumping mechanism on flow, pressure, etc., in the isolated vascular system. In addition, this technique would be useful in separating vascular from cardiac effects of various drugs and hormones which influence the cardiovascular apparatus. This report describes a pump, which, while being substituted for either chamber of the heart, can be regulated over a wide range in respect to rate, output, and ejectile velocity.

Preliminary studies on dogs are being made with the diaphragm pump shown in Fig. 1. The pump is driven by a variable speed motor contained in an

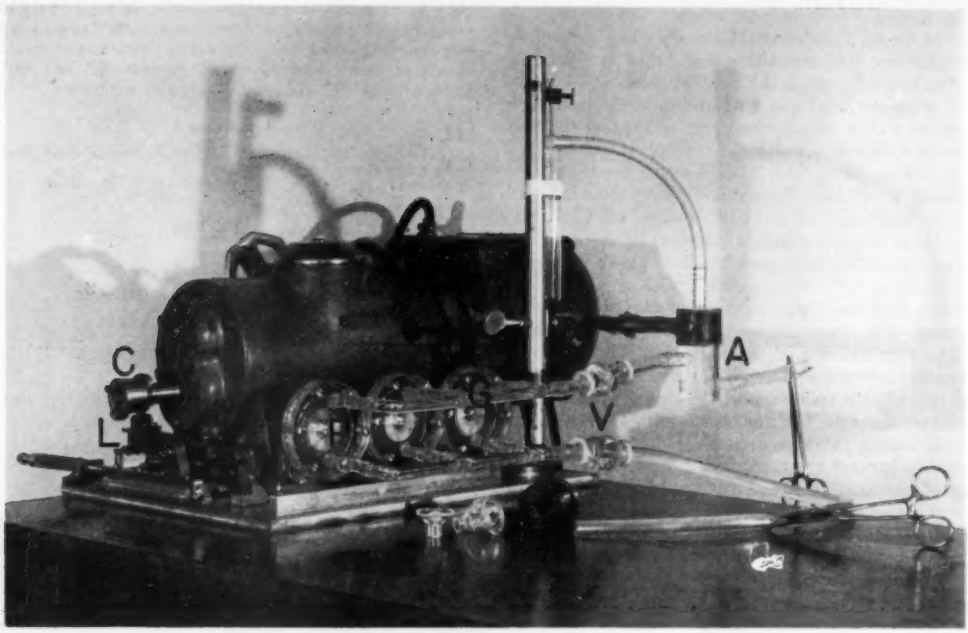

FIG. 1. Variable cardiac pump.

explosion-proof housing, with a range from 44 to 350 rpm. The driving cam, *C*, is so shaped that the discharge characteristics from the pump are similar to those from the heart. A selection of cams is available, so that the ejection time can be varied from one tenth to three quarters of the whole cycle. *L* is a lever with a movable fulcrum so that the output per stroke can be varied at will from zero to the maximum. Pump heads, *P*, are made so that the blood is in contact only with plastic. The heads are made of machined and polished methyl methacrylate, and the diaphragms are covered with thin sheets of polyethylene. Junction of the outputs of the three pumps is made with a glass connector, *G*, covered on the inside with silicone, to reduce the coagulation of blood. The ball check valves, *V*, are machined from solid methyl methacrylate and carefully polished. The ball is made of hollow methyl methacrylate with a specific gravity approximately equal to 1. Hufnagel (*4*) has shown that clotting does not take place in properly constructed valves made of suitable plastic material. Input and output connections are made of Tygon plastic tubing 1 cm in diameter. *A* is an air trap.

It should be emphasized that the present pump is not designed to substitute for the entire heart and lungs; rather, it may be used to replace either the right or the left ventricle, leaving the lungs and the opposite chamber of the heart to function normally. Thus, in the present preliminary experiments the input side of the pump is connected to the left auricle, and the output connects directly to the aorta. The right side of the heart and the pulmonary circulation are left undisturbed. The changes in arterial pressure, flow, and pulse wave contours, as well as venous pressure and venous return in response to controlled variations in the pumping mechanism, are then measured.

Figs. 2, 3, and 4 provide specimen data to illustrate

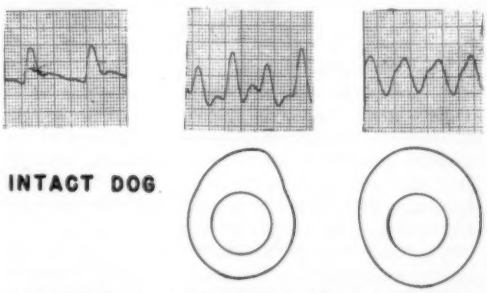

FIG. 2. Cuttings taken from record of femoral arterial pressure pulses (above) and outlines of cam shapes (below). Rotation of cams from right to left. Note alteration of pulse wave form in response to varying the cam shape.

different applications of the pump in physiological studies. Fig. 2 shows the effect of varying cam shapes on the femoral arterial pressure tracing; Fig. 3 illustrates the effect of a sudden increase in stroke output of the pump on systemic arterial pressure, venous pressure, and pulmonary arterial pressure; Fig. 4 shows the difference between the type of arterial pressure response to epinephrine in the intact dog

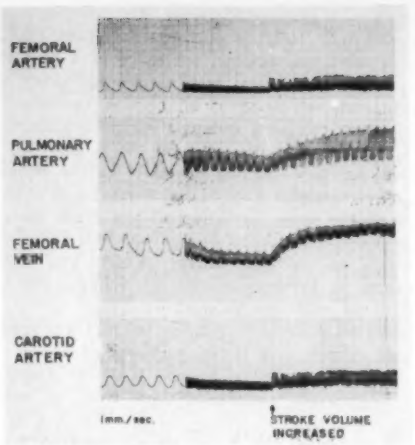

FIG. 3. Cuttings from tracings in femoral, carotid, and pulmonary arterial pressures and systemic venous pressure. Paper speed at 25 mm/sec changed to 1 mm/sec. Stroke volume of pump was suddenly increased at the arrow, resulting in an abrupt elevation of systemic arterial pressure, followed by a more gradual elevation of pulmonary arterial pressure and venous pressure. (The pulsations in the latter probably are transmitted from the aorta, the catheter being introduced into the femoral vein and advanced into the inferior vena cava.)

as compared to same animal when the pump is used to substitute for the left ventricle. This application appears to be a useful method of separating the peripheral from the cardiac actions of agents that affect the cardiovascular system. Detailed physiological data will be reported elsewhere.

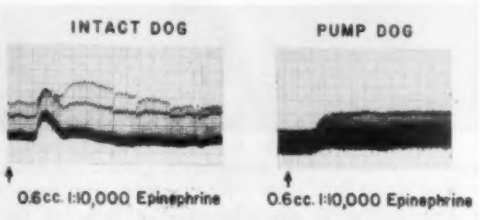

FIG. 4. Cuttings of femoral arterial pressure following the intra-aortic injection of 0.6 mg epinephrine in a dog before and after substituting the pump for the left ventricle. In the intact dog an initial vasoconstrictor response is seen as the epinephrine stimulates the peripheral vessels. Later, as this agent reaches the heart the cardiac effects predominate, with a further rise in systolic and a fall in diastolic pressure. After replacing the left ventricle with the cardiac pump, a similar dose produces only the initial vasoconstrictor response.

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Kallikrein and Shwartzman-Active Substances

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An observation is described concerning a combined action of Kallikrein and certain filtrates from bacterial cultures capable of producing the Shwartzman (*1*) phenomenon. This phenomenon in its basic form is a hemorrhagic reaction in rabbit skin. An intracutaneous injection of the bacterial filtrate, followed 24 hr later by an intravenous injection of the same filtrate, elicits the reaction at the prepared skin site within 4 hr after the intravenous injection. Many variations and modifications of the phenomenon are known, but it has remained unexplained. Kallikrein, the blood pressure lowering factor described by Kraut, Frey, and Werle (*2*), is chiefly found in the pancreas, from which it enters the blood and is kept inactivated, being activated only under certain conditions, such as stasis and changes in the pH. Kallikrein, given intravenously, brings about dilatation of the peripheral vessels, thus lowering the blood pressure. It also enhances the permeability of the dilated vessels. Much intricate detail is known concerning the enzymelike behavior of Kallikrein. The factor has not been isolated chemically.

Two experiments with different ways of combining Shwartzman-active substances and Kallikrein are reported here, but other combinations have been examined with the same result: hemorrhagic reaction.

One hundred sixty units of Kallikrein were dissolved in 0.5 ml of Shwartzman-active meningococcus bacterial filtrate and injected intravenously into the ear of a rabbit. The ear was clamped for 3 min, during which the injection was performed. In less than 4 hr a severe hemorrhagic-edematous reaction was evident in the ear, which was hanging down thick and filled with blood. A slight pull caused the hairs of the ear to come off in tufts, exposing a wet, dark red-blue distended surface.

Control rabbits receiving Kallikrein only, and in a dose of 160 units, showed hyperemia of some duration, but no other reaction.

In the second experiment, when an intracutaneous injection into the skin of the abdomen of the rabbit was made with meningococcus bacterial filtrate, and followed 24 hr later by an intravenous injection of 160 units of Kallikrein, a strong hemorrhagic-edematous reaction resulted at the site of the intracutaneous injection in less than 4 hr after the intravenous injection.

Further work on the subject, together with the interesting theoretical aspects, will be published.

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Response of Field-grown Peaches to Strontium Sprays

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The application of a strontium chloride spray to peach trees eliminated a marked chlorosis of the leaves. The trees, Red Elberta variety, were planted in 1946 on a sassafras loamy sand. This soil is marked by a low organic matter content and low exchange capacity. For the past several years the trees have grown rather poorly, and there has been considerable dieback.

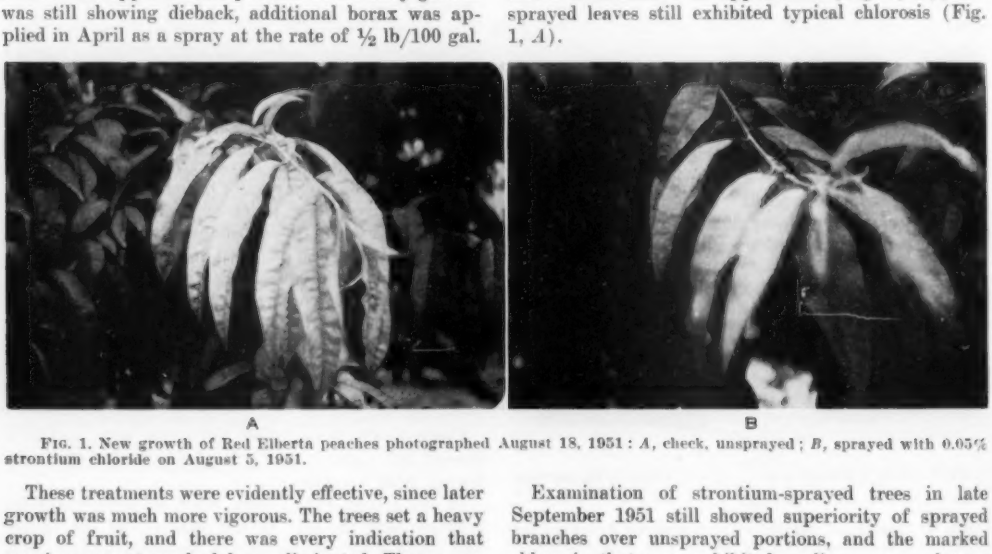
This past year a fertility program was initiated in an effort to improve vigor of the trees. A dormant spray of zinc sulfate at the rate of 10 lbs/100 gal water was applied in February. The trees had been fertilized in March 1951 with 1000 lbs/acre of a 5-10-10 containing 10 lbs borax, 20 lbs Tecmangam, and 10 lbs copper sulfate per ton. Since early growth was still showing dieback, additional borax was applied in April as a spray at the rate of ½ lb/100 gal.

These treatments were evidently effective, since later growth was much more vigorous. The trees set a heavy crop of fruit, and there was every indication that previous symptoms had been eliminated. There were indications by late June, however, that the trees were beginning to suffer from lack of nitrogen. There were only 5 lbs of available soil nitrogen per 2,000,000 lbs of soil as measured by rapid tests (*1*); also, leaves were a pale-green color, and new growth had been slowed. An application of 150 lbs sodium nitrate/acre was made in an effort to correct this situation.

In a few weeks most of the trees showed excellent response to the applied nitrate. However, about 20% of the trees showed a peculiar chlorosis (Fig. 1, *A*) of new leaves. This resembled to a marked extent advanced iron deficiency, with its characteristic lack of green color between the veins. Accordingly, a spray of 0.05% (by weight) of ferrous sulfate + 0.025% sulfuric acid was applied to leaves of a few trees. There was no beneficial response to this spray or to a manganous sulfate spray of the same concentration. A relatively complete nutrient spray[1] containing N, P, K, Ca, Mg, Fe, Mn, Zn, Cu, B, S, and Mo was applied, but this too had no effect on the chlorosis.

A spectrographic analysis of normal and chlorotic leaves of the same physiological age from the same tree revealed that normal foliage had 10 times as much strontium as chlorotic leaves. There was 0.002% strontium in the ash of normal foliage, but only 0.0002% in chlorotic foliage.

Strontium chloride (0.05% by weight) was sprayed on both upper and lower surfaces of leaves and branches of portions of several trees on August 5, 1951. Unsprayed portions of these trees, as well as unsprayed trees, were left as checks. Within 3 days a definite response was noted on all sprayed leaves. They were markedly greener, with little or no areas without normal color. By August 18, all sprayed leaves were normal in appearance (Fig. 1, *B*); unsprayed leaves still exhibited typical chlorosis (Fig. 1, *A*).



A B

FIG. 1. New growth of Red Elberta peaches photographed August 18, 1951: *A*, check, unsprayed; *B*, sprayed with 0.05% strontium chloride on August 5, 1951.

Examination of strontium-sprayed trees in late September 1951 still showed superiority of sprayed branches over unsprayed portions, and the marked chlorosis that was exhibited earlier was no longer present. This improvement was also noted in unsprayed trees and, therefore, cannot be due to migration of strontium from sprayed branches to other areas of the tree.

Upon noting response to strontium in this location, strontium chloride sprays were also applied to portions of several trees in two other orchards. Sprayed trees were weak, with considerable dieback, and had poor, thin leaves, but they did not show chlorosis. Strontium sprays in these latter orchards failed to give any visual sign of response.

[1] A commercial mixture sold under name of Plant-Thrive applied as a spray at rate of 4 lbs/100 gal water.

The results shown by this brief study would indicate that strontium chloride sprays have a definite value for peach leaves under certain conditions. Leaves benefited showed a definite pattern of chlorosis and a relatively small amount of strontium in the ash. It is believed that new growth stimulated by sodium nitrate application forced a deficiency which otherwise might not have revealed itself.

The response of plants to strontium has been reported by several authors (*2–4*). It has been indicated that in some of this response strontium took the place of calcium when the latter element was present in short supply. In the particular peach orchard where we obtained response to a strontium chloride spray, the calcium as measured by rapid soil tests (*1*) was 450 lbs/2,000,000 lbs of soil, or a comparatively poor test for calcium. It is of interest to note that the ash of normal leaves contained 0.9% calcium, whereas that of chlorotic leaves contained 0.04%, or about 1/20 as much. It is possible that here, too, strontium was replacing calcium, although calcium in the nutrient spray and 450 lbs soluble calcium in the soil failed to bring about normal growth.

The failure of calcium in both the spray and the soil to correct the condition noted raises the question as to whether strontium has specific value to the plant. If it does, is it then possible that we are adding large quantities of calcium in the form of lime, etc., in order to supply a small amount of strontium as well as calcium and to influence pH? Spectographic analyses of limes and gypsum have revealed the presence of strontium as an impurity. These analyses indicate that it is possible to add significant quantities of strontium to the soil by large applications of lime or gypsum. (For example, a ton application can easily supply about 2 lbs of strontium.)

These facts may help to explain why large quantities of calcium in the soil are usually associated with higher yields. Best yields are associated with calcium in amounts of several thousand pounds per acre, and yet most crops remove less than 50 lbs calcium/acre. The value of calcium in the form of gypsum or lime as soil conditioners is not lost sight of. However, it would be of interest to determine whether the extra value of calcium is due in part to the strontium carried as an impurity.

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Comments and Communications

The Role of Vision in the Alighting of Birds

Alighting is a critical point in the flight of birds. Only precise control can prevent destruction when a body designed for swift travel in a gaseous medium is brought into contact with solid earth, and both birds and aircraft approach a landing point into the wind to decrease landing speed. But, whereas conventional airplanes need to make landing runs at relatively high speed, the mobile wings of birds actually permit alighting motions functionally equivalent to those of a helicopter's rotors. In fact, the landing speed of a bird *must* be low, because it has no wheels to roll on and take up the alighting impact on a shock-absorbing landing gear.

This paper concerns the means of determining wind direction that may be available to an alighting bird. Whenever the wind approaches 10 mi/hr, birds turn into the wind at the moment of contact with the earth. Do they do so visually (a pilot without special instruments observes a wind sock at the airport), or do they feel the wind on their feathers or on their very large eardrums?

Here it must be pointed out that a bird aloft is part of the airstream, a fact missed by the writer in a recent paper(*1*). It feels no wind, whether it is in a hurricane or a light breeze. Aircraft navigation proves that ground speed is obtained from air speed by simply adding or subtracting the wind vector. A bird flying at an air speed of 30 mi/hr, with a 20-mi tail wind, is making a ground speed of 50 mi/hr—with a 20-mi head wind, 10 mi/hr. There is a theoretical weakness, therefore, in the idea that flying birds "feel" the wind, so it was decided to test the role of vision in alighting. If wind direction were determined visually, birds would have no way of knowing on a dark night if they are flying 50 mi/hr or 10 mi/hr, yet this would be very important in alighting. In the former case, when the bird had reduced its air speed to zero, it would still have a ground speed of 20 mi/hr from the tail wind, and it might be killed.

In an effort to solve this problem, 21 birds were flown blindfolded: 16 pigeons (*Columba livia*), 3 English sparrows (*Passer domesticus*), and 2 juncos (*Junco hyemalis*). The most effective blindfold was a narrow sleeve of thin black rubber, drawn over the head. A long, light cord was tied to one leg to prevent an occasional individual from flying off. The birds were flown in unfamiliar surroundings on dull days and were hand-released at heights of 6′ or so. Three pigeons and 2 English sparrows flew straight up and attempted to escape blindfolded, but tired of this shortly and fluttered to the ground like the rest. The

wind exceeded 5 mi/hr but was probably not much more than 10 mi/hr. Each individual was released repeatedly from all four quarters of the compass until a consistent behavior pattern for that individual seemed evident.

Upon release no birds consistently altered course to alight either with or against the wind. Several regularly hovered instead of alighting immediately, and these, as well as several others, spiraled in the air before alighting, not generally changing direction more than 180°. Different individuals consistently spiral either clockwise or counterclockwise, without respect to wind direction, and this is interpreted as normal spiral movement, characteristic of free-moving organisms (*2*). A bird released into the wind and rotating 180° would cover about 25′ before alighting, because of the tail wind most of the way, and would come in contact with the earth with too much velocity (perhaps 15 mi/hr). The same individual, released with the wind and spiraling about 180° into the wind, would make a short, hovering flight of about 5′, alighting at near zero velocity. Generally, the birds simply fluttered to the ground in the direction released, regardless of wind direction. They obviously did not know how near to the ground they were at the instant of impact, and sprawled with wings and tail outspread.

The eardrum, only thinly screened by the auricular feathers, and with an area in small birds up to 10 times the relative area in man, may probably be eliminated from any role in detecting wind direction. The sparrows, juncos, and 3 pigeons were flown with auricular feathers removed, and no change in behavior was noted whether the ear was covered by the blindfold rubber or not.

These experiments should be repeated by investigators with larger numbers of species and individuals available. Interpretation of this kind of behavior is somewhat subjective, and a larger number of trials might result in different conclusions.

However, our results indicate that birds alight by visual cues. They normally turn to alight into the wind whenever it reaches velocities approaching 10 mi/hr. It is also known that, although birds hold their heads in a characteristic position of rest in arising and maneuvering, they turn them intently downward upon alighting. I believe they are observing the let-down point, in most cases binocularly. If they sense that their speed is too high, they know the wind is behind them and make a sharp turn of 90° to 180°, alighting the instant the wind cancels forward movement. If the wind is less than 5 mi/hr, they pay no evident attention to it, alighting indiscriminately from any direction.

The importance of vision in the alighting of birds may explain migration catastrophes like the one that occurred on the night of March 13–14, 1904, when millions of migrating Lapland longspurs encountered a cold front with heavy snow and were killed in violent collision with the earth. Most small birds migrate at night, feeding and resting by day; a migratory flight launched on a dark night may actually be unable to land safely until daylight. In fact, the well-known visual acuity of birds is largely due to the great cone-density of the retina, which is generally so poor in rods as to be inferior even to the human retina for night vision.[1]

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[1] For help in obtaining and flying birds I am indebted to R. Marlin Perkins, J. Lear Grimmer, Robert Smolker, and Karl Bartel.

Insect Resistance to Insecticides

THE problem of the development of resistance to insecticides among insects is becoming increasingly important. In laboratory studies and observations on the development of such resistance, advantage is taken of the dosage response, and it is generally assumed that individuals surviving high dosages of toxicants are inherently resistant. If chemically selected individuals are bred generation after generation, a resistant strain should be developed. This has indeed been demonstrated in some instances, but not in others. The development of resistance by physiologic mutation is a very real possibility, but it has not been possible to distinguish positively between mutation and selection of an existing natural resistance, as has been done with bacteria.

Some toxicologic data being prepared for publication elsewhere could not be explained satisfactorily on the basis of the variation expressed by the slope of the dosage-response curve. This variation relates directly to the standard deviation and can be viewed as the range of individual responses about the mean of the test group. In addition, there appear to be types of variation, not expressed by the dosage-response curve, which have been largely neglected in selecting for resistance, and which may be far more critical in the understanding of how resistance is developed.

One type of variation is that of the individual insect. The belief that an individual maintains a static position in the population of which it is a member, and hence that those individuals surviving chemical treatment are genotypically resistant, is probably without foundation. There is no way of knowing, of course, how all individuals would respond to a second administration of the toxicant when death is the criterion of response. If recovery time following the administration of a stupefacient (carbon dioxide, nicotine, cyanide) is used as a measure of susceptibility, it is found that a dynamic variation exists among the insects tested (*Galleria* larvae, *Oncopeltus* adults, *Habrobracon* adults). An individual recovering rapidly from one exposure may be slow to recover from the next, and vice versa. If a series of tests is made, each individual responds by recovering in times

of different magnitude. Although a central tendency can be calculated, it varies among different insects. Thus, the mean would seem to be a much better measure of an individual's inherent susceptibility than response to a single test. If such dynamic variation exists when measured by recovery time, it is not unreasonable to assume that it exists when mortality is the end point observed. Unfortunately, a mean lethal dose cannot be estimated for each individual.

Another type of variation than that expressed by the standard deviation is that of the means of the test groups. Even though the slope of the dosage-response curve for a given toxicant applied to a test insect is relatively stable, it is well known that the LD_{50} is found to vary from day to day, from culture to culture, from laboratory to laboratory, and from one condition (e.g., temperature) to another. It is thought that some of these observed differences are due to differences in technique, and certainly some of them are. But considering the world population of a single insect species, each test group is but a small sample of the population at a particular time. The means of all test groups must vary widely from place to place, from time to time, and under different conditions, even though the techniques for study might be identical. At present nothing is known about the distribution of these group means. The range of distribution might be so wide, however, that in localized areas little chemical selection would be required for segregation of resistant groups.

Of the three variations—variation in response by the individual insect, variation in response by individuals about the group mean at a particular time, and variation of the means of test groups (considering the entire population of the species at all times)—only the second can be described easily, and only this one has been used in selection for resistance. And yet this may be the one least likely to yield the desired results. If the first type of variation is to be found generally with different insects and with different toxicants, the apparent phenotype as judged by a single test may be quite different from the genotype, and genetic studies based on selection using the dosage-response curve may be faulty, success being largely fortuitous.

There is one technique that has been used with signal success in demonstrating development of resistance in the laboratory, probably because the first type of variation is unwittingly taken into consideration. This technique (Bruce and Decker, *Soap Sanit. Chemicals,* **26**, [3], 122, 145 [1950], and others) involves the exposure of houseflies to DDT—not as a single application, but continuously throughout larval life. This treatment would eliminate any individual which was even temporarily susceptible and would permit survival of only those individuals that were consistently resistant.

By taking cognizance of these three types of variation, it may be possible to reconcile data that now appear conflicting, but to do so requires more information about the distribution of the respective variations, their interrelationships, and the physiologic and ecologic factors contributing to each. Certainly, genetic studies can be conducted on a more secure basis if this information becomes available.

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Research vs. Proprietary Interest

WHY is it that many scientists are behaving like the "man in the street," who may be a well-balanced individual until someone brings up a controversial subject in religion or politics? I had always considered a good research man as the best available example of judicial detachment, able to study scientific matters objectively, and to discard even his own data if found to be of doubtful significance.

Now I am unhappily discovering that a considerable number of rather important scientists are unable to discuss security regulations or loyalty oaths without exhibiting either an attitude of sophomoric resentment or the type of prejudiced argument one expects from the man in the street, to whom the subject under discussion appears to be either all white or all black. Although there have been some calm and scholarly presentations of certain dangers to academic and scientific freedom, such have not seemed to be the rule. In a subcategory of this group, I find that some scientists who have served with, or been in contact with, the military allow themselves to sound off much like the ex-soldier who hated the first sergeant.

Enough of complaint. All our training and experience in research lead us automatically to consider both sides of a moot question. Matters of procedure now being argued—in typical American style—are of the gravest importance to the future of research and to the future of our country. Both these matters are important. It is the security of our country that makes possible the significant advances in all of science. Men of the greatest sincerity are trying to maintain that security, and those who are charged with that duty are obliged to set up rules, a procedure necessary in any institution of great size. It is true that some of the men who administer these rules, although possibly sincere, may be men of limited vision. It is also true that there are occasions when the earnest scientist, immersed in his own problems, finds a fence where he thought to find a gate, and in his frustration speaks out in unscientific style (most of us show such human frailty at times). May we not wait to cool off, however, before we write a book or a review about it?

It appears to the writer that scientific research, like all human existence, is beset with obstacles, differences of opinion, obstinate data, annoying rules, limitations of time and space, etc. To that is now added the occasional cooperation and sometimes the supervision of some government agency. Not all of us will admit that this supervision is necessary (some of us still dislike stop signs in traffic regulation), but the situation does exist. It is certainly not palatable to consider this as

a sort of parental supervision, considering the mental caliber of some of the supervisors, but it could be likened to a business or family partnership. The wise man knows that his business partner or his wife may sometimes want to go when he wants to stay, but he also knows that the disadvantages of the partnership —the items on which he surrenders his own preference —are greatly outweighed by the advantages. Therefore, he accepts certain limitations. Is it not possible to do scientific work within such a framework in some degree of contentment, at least until certain potential dangers have receded?

If the trends that appear to threaten academic freedom and even seem to hamstring the progress of research are as dangerous and ominous as claimed, why not consider the matter as a research problem and really study both sides? This type of thing is susceptible of reasonable solution in the conference room, provided both sides are represented by intelligent men who can see the forest as a whole, as well as by men who are still threading their way through the trees. The military and administrative sides must be properly represented, for the scientists alone may find it difficult to make up their collective mind (*cf.* the National Science Foundation!). Of course, we scientists admit privately that our mental processes are a bit superior, but let us try to listen with complaisance to the viewpoints of others.

The turmoil about faculty loyalty oaths has always puzzled the writer. Is it entirely because of the threat to academic freedom, or do unmentioned feelings of personal dignity regarding the unassailable integrity of the scholar complicate the situation? This is only one point of view, but the writer would be very happy to see the research scientist approach the whole problem with more scientific detachment, trying to understand the necessities of those charged with the protection of our national security (and with it our fine research facilities), recognizing without condoning certain weak links in the administrative chain, and, above all, carrying scientific methods and ideals and dignity into the argument, not forgetting these ideals when someone gets a blow on the nose.

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Pressor and Oxytocic Hormones of the Pituitary Gland

IN THE past few years, by the use of improvements in analytical methods of extraction and of adsorption and elution, du Vigneaud and his collaborators (Pierce and Turner) have added much to previous knowledge concerning the chemistry of the pressor and oxytocic hormones of the pituitary gland. Enough is now known concerning the amino acid constituents of these hormones to warrant the following observations concerning the relationship between them.

According to du Vigneaud and his collaborators, the acids common to both hormones are tyrosine, proline, glutamic acid, aspartic acid, glycine, and cystine. In addition to these, the pressor hormone contains arginine and phenylalanine, and the oxytocic hormone, leucine and isoleucine.

The presence of phenylalanine in the pressor hormone is in contradiction to the work of Stehle and Fraser, who reported it to be absent. The absence of isoleucine from the same hormone is in contradiction to the work of Stehle and Trister, who reported it to be present. The work of Stehle and his collaborators was done with a preparation much inferior in potency to that investigated by du Vigneaud and his collaborators. The isoleucine reported by the former may have been contained in the ballast of the pressor preparation. The absence of phenylalanine is not easily explained, since conditions were favorable for its detection. If the reader is willing for the moment to accept the results of Stehle and his collaborators as correct, the results of du Vigneaud and his collaborators have what seems like a plausible explanation. In the starch column method of separation, phenylalanine and isoleucine appear in close sequence in the eluate, so that it is possible what was reported as phenylalanine may have been isoleucine.

If this is true, then the interesting conclusion follows that the only difference between the pressor and oxytocic hormones is the occurrence of leucine instead of arginine in the oxytocic hormone and, vice versa, the occurrence of arginine instead of leucine in the pressor hormone. The possibility that one hormone may be derived from the other occurs immediately. The introduction of a guanidine group into leucine with the elimination of a methyl group would convert the oxytocic hormone into the pressor hormone. The reverse, the conversion of the pressor hormone into the oxytocic, requires the elimination of the guanidine radical from arginine and the introduction of a methyl group.

The ideas expressed are not compatible with the conception that the two hormones are split products of a giant molecule.

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Electrokinetic Behavior of Dilute Monodisperse Sulfur Hydrosols

THE development of dilute monodisperse sulfur hydrosols by LaMer and Barnes (*1*) has resulted in the study and solution of a number of problems previously unattainable with polydisperse sols (*2–5*). However, the electrokinetic properties of the dilute monodisperse sols had not been studied in connection with any of these investigations.

Recently such a study was made, using a microelectrophoresis method (*6*). Sols prepared with dilute sodium thiosulfate (0.002 *M*) and HCl (0.001–0.003 *M*) were found to contain ***positively charged particles***. Previously, the charge on the sulfur particles in

sols prepared from concentrated reagents had always been found to be negative, presumably because of the pentathionate ion produced in the chemical reaction, which becomes strongly bound to the particles (*7*). Our investigations have demonstrated that the fundamental reason for the existence of positively charged particles in the dilute sols is the absence of a significant concentration of pentathionate ion. Under these circumstances hydrogen ion can become the charging species. The positive charge decreases with increasing pH. The particles are isoelectric at pH of approximately 4, and negative at higher pH values. When extremely small amounts of sodium pentathionate were added to the dilute monodisperse sols (final concentration of $Na_2S_5O_6 = 1\text{–}2 \times 10^{-5}$ *M*), the positive charge was immediately reduced considerably or completely reversed. Such experiments indicate that the concentration of pentathionate in the original dilute sols is always less than 1×10^{-5} *M* many hours after mixing the reagents.

In a recent paper Dinegar, Smellie, and LaMer drew the same conclusions concerning the pentathionate ion concentration in these dilute sols from the results of chemical measurements (*8*).

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Book Reviews

Carbon Dioxide Fixation and Photosynthesis. Symposia of the Society for Experimental Biology, No. V. New York: Academic Press, 1951. 342 pp. $6.80.

The papers read at the Sheffield meetings of the Society for Experimental Biology in 1950 are now available in book form. They attest to a carefully planned program in which various phases of the general problem of photosynthesis have been ably presented by persons whose efforts have contributed materially to a better understanding of this complicated process. Included are discussions of the most important physical, chemical, comparative-biochemical, and biological aspects. On the whole, the material has been very well integrated.

The first four chapters, by H. A. Krebs, H. G. Wood, S. Ochoa, and D. Herbert, set forth the development of our comprehension of carbon dioxide assimilation by nonphotosynthesizing organisms. They show how, from the discovery of this phenomenon, now some 15 years ago, detailed investigations have resulted in a definition of several of the specific reactions involved, including the isolation and characterization of enzymes and coenzymes that play a role in CO_2 fixation by animal tissues and microorganisms. Herbert's paper, especially—containing much otherwise unpublished material and a penetrating critical analysis of existing discrepancies—is a fine contribution.

Three succeeding chapters are concerned with aspects of the metabolism of higher plants. M. Thomas discusses crassulacean acid metabolism; because of the emphasis in the first four chapters on the mechanism of formation of certain di- and tricarboxylic acids, it provides a link with the first part of the book. The subject matter treated by Thomas, however, is, from the point of view of a biochemical analysis, still in a rudimentary state. The papers by O. V. S. Heath, and by H. L. Penman and R. K. Schofield, dealing, respectively, with assimilation by leaves with stomatal control eliminated, and with some physical aspects of assimilation and transpiration, conclude this "biological interlude." The three chapters provide many examples of the complications attending studies with higher plants.

The next three chapters are an excellent introduction to the photochemical basis of the photosynthesis problem. The photochemical formation and reactions of atoms and radicals in aqueous systems are discussed by M. G. Evans and N. Uri; photochemical oxidation-reduction processes, also in aqueous systems, by Jos. Weiss; and the resonance transfer of energy between molecules by E. J. Bowen. The general treatment of these aspects is so admirable, and the implications for a better understanding of the mechanism of photosynthesis are so clearly evident and so well presented, that a careful study of these chapters cannot be too strongly recommended.

James Franck's paper on the physical background of photosynthesis summarizes the application of physical principles to the formulation of an integrated picture of a general mechanism. The section on physical aspects is concluded with a chapter by M. S. Nishimura, C. P. Whittingham, and Robert Emerson on the maximum efficiency of photosynthesis, representing a critical evaluation of this much debated and controversial field, and one by B. Kok on photo-

induced interactions in the metabolism of green plant cells, with additional remarks on quantum efficiency.

The more specifically biochemical phase of the subject is introduced by R. Hill, whose epoch-making researches in 1939 provided the first opportunity for approaching a study of the photosynthetic mechanism by means of enzyme-chemical methods. Hill's paper on reductions by chloroplasts, dealing with the most important biochemical consequences of his work, is followed by a chapter by C. S. French and H. W. Milner in which significant methodological developments in the preparation of photochemically active suspensions of fragmented chloroplasts are discussed. Wassink's paper on the reducing action of light in photosynthesis reviews a number of observations generally supporting the thesis that light absorption by photosynthesizing organisms generates reducing power. Two further chapters, by H. Gaffron, E. W. Fager, and J. L. Rosenberg, and by M. Calvin and collaborators, describe the exciting results of studies with carbon dioxide, labeled with C^{14}, and aimed at unraveling the stages by which CO_2 is transformed into organic matter during photosynthesis. The application of isotopes, combined with the use of refined analytical procedures, for the separation and identification of labeled products (ion-exchange columns, paper chromatography, radioautography) has yielded information that could not otherwise have been obtained. This phase is currently in so active a state of development, however, that the detailed interpretation of the results given in the present volume is rapidly being modified by subsequent studies.

An excellent feature of the book is the inclusion of three final chapters, two by O. Warburg, D. Burk, and A. L. Schade (with J. Hunter coauthor of the second), and one by H. A. Krebs. In these papers, recent innovations in the methodology for conducting photosynthesis experiments, for measuring light absorption, and for determinations of gas exchanges in photosynthesizing or respiring cells are described in sufficient detail to make them generally available. Anyone familiar with the limitations of earlier methods will realize the importance of these new techniques.

For persons interested in the general problems of carbon dioxide assimilation and photosynthesis, the book is obviously required reading. But specialists in other fields can also benefit from a study of its contents; they will find in it a great deal of important information, on the whole well written and ably presented. The book is a credit to the planners of the symposium and to the contributors.

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Pathology of the Fetus and the Newborn. Edith L. Potter. Chicago: Year Book Pub., 1952. 578 pp. and 601 figs. $19.00.

This large, important volume represents an exhaustive treatise on the morbid anatomy of all diseases affecting the fetus and the newborn. It is written by the leading authority on this subject and represents the results of 18 years of patient and accurate observation on the pathogenesis of fetal and neonatal death in a large maternity hospital. Its material has been drawn not only from the Chicago Lying-in Hospital and the Chicago Board of Health, but from the many physicians of that city and elsewhere in this country who recognize Dr. Potter's prominence in this field of human medicine. The author's credo is best expressed in her own words when she says, "The description of the body of a dead infant is of no value as an isolated piece of information, but if it is integrated with the various aspects of heredity, conception, development, intrauterine and extrauterine environment and behavior it becomes part of an important chronicle."

The material is well organized and arranged. Subjects of broad interest, such as causes of fetal and infant death, or prematurity, are appropriately grouped as chapters comprising the first third of the volume, and the specific organ systems and their diseases occupy the remaining chapters. The bibliography, although not exhaustive, is more than adequate for students in this field. The indexing is of high order.

The format is pleasing and the illustrations are numerous and of superb quality. The rare printer's error, such as the transposition of two lines on page 116, in no way detracts from the excellence of the printing.

This is the most modern and complete work on this vital phase of human disease. Although written by a pathologist as an authoritative compilation for her fellow-pathologists, it is a treasure house of correlated embryologic, anatomic, pathologic, and clinical data on the fetus and the newborn infant who has failed to survive.

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Scientific Book Register

Disease in Plants: An Introduction to Agricultural Phytopathology. Neil E. Stevens and Russell B. Stevens. Waltham, Mass.: Chronica Botanica; New York: Stechert-Hafner, 1952. 219 pp. $4.75.

Les Théories Électroniques de la Chimie Organique. Bernard Pullman and Alberte Pullman. Paris: Masson et Cie, 1952. 665 pp. 5800 fr.

Histopathological Technic: Including a Discussion of Botanical Microtechnic. 2nd ed. Aram A. Krajian and R. B. H. Gradwohl. St. Louis: Mosby, 1952. 362 pp. $6.75.

Diseases of Vegetable Crops. John Charles Walker. New York–London: McGraw-Hill, 1952. 529 pp. $7.50.

Surgery and the Endocrine System. Physiologic Response to Surgical Trauma—Operative Management of Endocrine Dysfunction. James L. Hardy. Philadelphia–London: Saunders, 1952. 153 pp. $5.00.

Limnology. 2nd ed. Paul S. Welch. New York–London: McGraw-Hill, 1952. 538 pp. $8.00.

Electrolytic Manganese and its Alloys. Reginald S. Dean. New York: Ronald Press, 1952. 257 pp. $12.00.

Meetings & Conferences

June 9–21. International Organization for Standardization (Triennial). Columbia University, New York.

June 11–13. American Congress on Surveying and Mapping. Washington, D. C.

June 11–13. Symposium on Electron Transfer and Isotopic Reaction. Division of Physical and Inorganic Chemistry, American Chemical Society, and Division of Chemical Physics, American Physical Society. University of Notre Dame, Notre Dame, Ind.

June 11–14. American Association of Physics Teachers (Summer). State University of Iowa, Iowa City.

June 12–14. Conference on the Use of Isotopes in Plant and Animal Research. Kansas State College, Argonne National Laboratory, and Isotope Division, U. S. Atomic Energy Commission. Kansas State College, Manhattan.

June 12–14. National Medicinal Chemistry Symposium, American Chemical Society. University of Virginia, Charlottesville.

June 15–19. American Society of Mechanical Engineers. Sheraton Gibson, Cincinnati.

June 16–17. American Mathematical Society, Symposium on Applied Mathematics. Carnegie Institute of Technology, Pittsburgh, Pa.

June 16–18. American Meteorological Society (National). Corvallis, Ore.

June 16–18. American Society of Heating and Ventilating Engineers (Semiannual). Essex and Sussex Hotels, Spring Lake, N. J.

June 16–18. Community Nutrition Institute. Syracuse University, Syracuse, N. Y.

June 16–18. National Colloid Symposium, Division of Colloid Chemistry, American Chemical Society. University of Southern California, Los Angeles.

June 16–18. National Fertilizer Association (Annual). The Greenbrier, White Sulphur Springs, W. Va.

June 16–20. American Crystallographic Association. Tamiment, Pa.

June 16–20. American Electroplaters' Society (Annual). Conrad Hilton Hotel, Chicago.

June 16–21. American Association for the Advancement of Science, Pacific Division. Oregon State College, Corvallis.

June 16–22. International Gas Conference. Brussels.

June 16–July 23. Biostatics Conference. Iowa State College, Ames.

June 16–Aug. 25. Gordon Research Conferences. Colby Junior College, New London, N. H.; New Hampton School, New Hampton, N. H.

June 18–20. Conference on Germ Cells, Ciba Foundation. London.

June 18–20. Conference on Optical Methods in Industry. Institute of Optics, University of Rochester.

June 18–20. Conference on Soil Stabilization. Massachusetts Institute of Technology, Cambridge.

June 18–20. Congress of the Organization for the Advancement of Spectrographic Methods. 1, Place St. Thomas d'Aquin, Paris.

June 19–20. American Management Association (General Management). Waldorf-Astoria, New York.

June 19–21. American Association of Genito-Urinary Surgeons. Seaview Country Club, Absecon, N. J.

June 19–21. American Phytopathological Society, Pacific Division (Annual). Oregon State College, Corvallis.

Publications Received

An Adhesive Tape-Resistor System. Nat. Bur. Standards Circ. 530. B. L. Davis. Washington, D. C.: GPO, 1952. 83 pp. Illus. 30¢.

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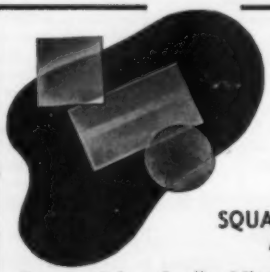

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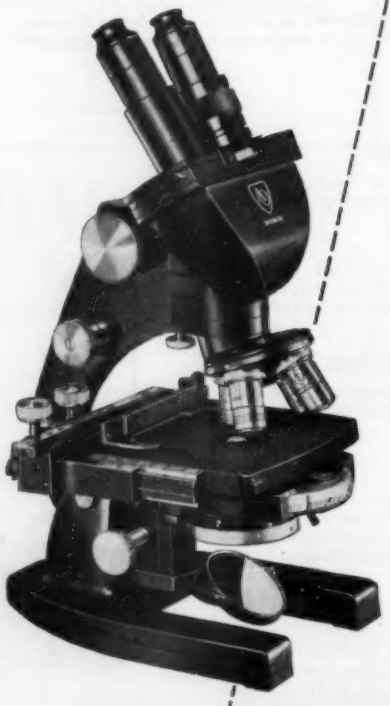

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